



**AN ANION CHARACTERIZATION OF A  
CONSTRUCTED WETLAND USED FOR  
CHLORINATED ETHENE REMEDIATION**

THESIS

Bradley M. Bugg, Captain, USAF

AFIT/GEE/ENV/02M-01

**DEPARTMENT OF THE AIR FORCE  
AIR UNIVERSITY  
AIR FORCE INSTITUTE OF TECHNOLOGY**

---

**Wright-Patterson Air Force Base, Ohio**

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

## Report Documentation Page

<b>Report Date</b> 26 Mar 02	<b>Report Type</b> Final	<b>Dates Covered (from... to)</b> Aug 2001 - Mar 2002
<b>Title and Subtitle</b> An Anion Characterization of a Constructed Wetland Used for Chlorinated Ethene Remediation	<b>Contract Number</b>	
	<b>Grant Number</b>	
	<b>Program Element Number</b>	
<b>Author(s)</b> Capt Bradley Bugg, USAF	<b>Project Number</b>	
	<b>Task Number</b>	
	<b>Work Unit Number</b>	
<b>Performing Organization Name(s) and Address(es)</b> Air Force Institute of Technology Graduate School of Engineering and Management (AFIT/EN) 2950 P Street, Bldg 640 WPAFB, OH 45433-7765	<b>Performing Organization Report Number</b> AFIT/GEE/ENV/02M-01	
<b>Sponsoring/Monitoring Agency Name(s) and Address(es)</b> Dr. Tom Stauffer AFRL/MLQ Barnes Ave Tyndall AFB, FL 32403	<b>Sponsor/Monitor's Acronym(s)</b>	
	<b>Sponsor/Monitor's Report Number(s)</b>	
<b>Distribution/Availability Statement</b> Approved for public release, distribution unlimited		
<b>Supplementary Notes</b> The original document contains color images.		

**Abstract**

Chlorinated ethenes physical properties as well as its ubiquitous state at DOD installations makes it a priority for innovative remediation efforts. Current techniques are expensive and time consuming to maintain. Constructed wetlands suggest an inexpensive and operational alternative to conventional technologies. Sub-surface flow wetlands provide the anaerobic zones necessary to reduce the recalcitrant chlorinated solvents prior to anaerobic or aerobic mineralization of its daughter products. A vertical flow cell to include sequential sedimentary layers of two hydric soil lifts and a mix of hydric soil and woody compost was the subject of this investigation. This study focused on the statistical significance among the three constructed strata. Concentrations of mono-carboxylic acids and other anions are indicators of the reductive conditions necessary for remediation. Acid anion concentrations were expected to be higher in the assumed anaerobic strata of the constructed cell as a result of the fermentation of humic substances. Decreases in sulfate and nitrate were also expected over the upward flowing, wetland profile due to the reductive, anoxic conditions. Evidence in this study validate these assumptions and suggest that constructed wetlands are a viable alternative to current remediation methods. Findings also suggest manipulation of the physical parameters such as strata depth, soil type, flow rate, etcof a wetland could increase the cells remediation effectiveness.

**Subject Terms**

Carboxylic Acids, Reductive Dechlorination, Organic Acids, Chloride, Fluoride, Sulfate, Nitrate, Nitrite, Constructed Wetland, Sub-Surface Flow

**Report Classification**

unclassified

**Classification of this page**

unclassified

**Classification of Abstract**

unclassified

**Limitation of Abstract**

UU

**Number of Pages**

263

The views expressed in this thesis are those of the author and do not reflect the official policy or position of the United States Air Force, Department of Defense, or the U. S. Government.

AFIT/GEE/ENV/02M-01

AN ANION CHARACTERIZATION OF A CONSTRUCTED WETLAND USED FOR  
CHLORINATED ETHENE REMEDIATION

THESIS

Presented to the Faculty

Department of Systems and Engineering Management

Graduate School of Engineering and Management

Air Force Institute of Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the Requirements for the  
Degree of Master of Science in Engineering and Environmental Management

Bradley M. Bugg, B.S.

Captain, USAF

March 2002

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

AN ANION CHARACTERIZATION OF A CONSTRUCTED WETLAND USED FOR  
CHLORINATED ETHENE REMEDIATION

Bradley M. Bugg, B.S.  
Captain, USAF

Approved:

                    //signed//                      
Michael L. Shelley, Ph. D. (Chairman)

12 March 2002  
Date

                    //signed//                      
James P. Amon, Ph. D. (Member)

8 March 2002  
Date

                    //signed//                      
Abinash Agrawal, Ph. D. (Member)

8 March 2002  
Date

                    //signed//                      
Charles A. Bleckmann, Ph. D. (Member)

12 March 2002  
Date

## **Acknowledgements**

This study would not be possible without the direction and mentoring of my thesis advisor, Dr. Michael L. Shelley. His patience and fortitude gave me confidence during somewhat demanding circumstances. I am indebted for his support during this thesis effort.

I was also fortunate to have distinguished doctorates from both the Air Force Institute of Technology and Wright State University sit in as advisors. Dr. James Amon and Dr. Abinash Agrawal of Wright State University spent numerous hours guiding me on theory and procedure. Dr. Charles Bleckmann of the Air Force Institute of Technology provided valuable insight on both field and laboratory experiences. Each committee member tackled perplexing issues with sound advice and patience.

Special thanks go to the personnel at the 88<sup>th</sup> Civil Engineering Squadron for their participation in wetland preparation. Without the help of Mr. Don Smith, Bob Kitchens, and Greg Bundy this study would have been delayed. Captain David Wilder was also most generous with his expertise in AutoCAD and presentation advice for most figures.

I am extremely indebted for the participation and moral support by my research partners, Major Andy Entingh and Captain Bryan Opperman. Their candor and dedication to one another's research made this one of the most demanding yet enjoyable experiences of my life.

Bradley M. Bugg

## Table of Contents

	Page
Acknowledgements .....	iv
List of Figures .....	xi
List of Tables .....	xii
Abstract .....	xiii
I. Introduction.....	1
Research Questions .....	9
II. Literature Review .....	10
Constructed Wetlands .....	10
Biodegradation Pathways .....	12
Electron Donor .....	13
Co-metabolism.....	14
Terminal Electron Acceptor.....	15
Organic Analytes .....	15
Inorganic Analytes .....	17
III. Methodology .....	19
Overview .....	19
Constructed Wetland .....	19
Wetland Preparation.....	20
Sampling Plan .....	20
Piezometer Placement Procedure.....	22
Sample Extraction.....	24
Piezometer Water Recovery.....	26
Sampling Procedure .....	27
Sample Preparation.....	28
Analysis.....	29



	Page
Instrumentation .....	29
Software Programming .....	31
IV. Results.....	32
Standards and Calibration.....	32
Method Detection Limit.....	34
Background and Blanks .....	35
Statistical Analysis.....	36
Outliers.....	37
Outlier Hierarchy .....	38
Distribution of Data .....	39
Findings.....	42
Population Comparison.....	45
Trend Analysis .....	47
V. Discussion.....	49
Sources of Variability and Bias .....	50
Recommendations .....	52
Conclusion .....	53
Appendix A: Plant Species Table .....	55
Appendix B: Sampling Procedure .....	56
Appendix C: Sample Preparation Procedure .....	57
Appendix D: Recovery Log for Top Strata.....	58
Appendix E: Recovery Log for Middle Strata.....	62
Appendix F: Wetland Preparation & Sampling Equipment .....	65
Appendix F: Wetland Preparation & Sampling Equipment .....	66

	Page
Appendix G: Analysis Equipment .....	68
Appendix H: Dionex Analysis Program for PeakNet 6.0 .....	69
Appendix I: Acetate, Strata A.....	71
Appendix J: Acetate, Strata B.....	76
Appendix K: Acetate, Strata C.....	81
Appendix L: Acetate, Field Blanks, Influent and Effluent .....	86
Appendix M: Butyrate, Strata A.....	87
Appendix N: Butyrate, Strata B .....	92
Appendix O: Butyrate, Strata C .....	97
Appendix P: Butyrate, Field Blanks, Influent and Effluent .....	102
Appendix Q: Chloride, Strata A.....	103
Appendix R: Chloride, Strata B .....	108
Appendix S: Chloride, Strata C .....	113
Appendix T: Chloride, Field Blanks, Influent and Effluent .....	118
Appendix U: Fluoride, Strata A .....	119
Appendix V: Fluoride, Strata B .....	124
Appendix W: Fluoride, Strata C .....	129
Appendix X: Fluoride, Field Blanks, Influent and Effluent .....	134

	Page
Appendix Y: Formate, Strata A .....	135
Appendix Z: Formate, Strata B.....	140
Appendix AA: Formate, Strata C.....	145
Appendix AB: Formate, Field Blanks, Influent and Effluent .....	150
Appendix AC: Lactate, Strata A.....	151
Appendix AD: Lactate, Strata B.....	156
Appendix AE: Lactate, Strata C.....	161
Appendix AF: Lactate, Field Blanks, Influent and Effluent .....	166
Appendix AG: Nitrate, Strata A.....	167
Appendix AH: Nitrate, Strata B.....	172
Appendix AI: Nitrate, Strata C .....	177
Appendix AJ: Nitrate, Field Blanks, Influent and Effluent .....	182
Appendix AK: Nitrite, Strata A .....	183
Appendix AL: Nitrite, Strata B.....	188
Appendix AM: Nitrite, Strata C.....	193
Appendix AN: Nitrite, Field Blanks, Influent and Effluent .....	198
Appendix AO: Propionate, Strata A .....	199
Appendix AP: Propionate, Strata B .....	204

	Page
Appendix AQ: Propionate, Strata C.....	209
Appendix AR: Propionate, Field Blanks, Influent and Effluent.....	214
Appendix AS: Sulfate, Strata A.....	215
Appendix AT: Sulfate, Strata B.....	220
Appendix AU: Sulfate, Strata C.....	225
Appendix AV: Sulfate, Field Blanks, Influent and Effluent.....	230
Appendix AW: Excluded Outliers for Statistical Analysis.....	231
Appendix AX: Contour Plots, Acetate (ppm).....	234
Appendix AY: Contour Plots, Butyrate (ppb).....	235
Appendix AZ: Contour Plots, Chloride (ppm).....	236
Appendix BA: Contour Plots, Fluoride (ppb).....	237
Appendix BB: Contour Plots, Formate (ppb).....	238
Appendix BC: Contour Plots, Lactate (ppb).....	239
Appendix BD: Contour Plots, Nitrate (ppm).....	240
Appendix BE: Contour Plots, Nitrite (ppb).....	241
Appendix BF: Contour Plots, Propionate (ppb).....	242
Appendix BG: Contour Plots, Sulfate (ppm).....	243
Bibliography.....	244

	Page
Vita.....	249

## **List of Figures**

Figure	Page
1. Constructed Cell Profile.....	20
2. Wetland Plots and Piezometer Placement .....	22
3. Typical Nest Among Stratum .....	23
4. Extraction Assembly .....	24
5. Ion Chromatography Flow Diagram.....	30
6. Chromatogram of Analytes at 10ppm.....	33
7. Outlier Scatterplot Matrix with 95% CI Ellipse of Strata C Acetate Amounts.....	37
8. Outlier Analysis, Strata C Acetate Using Mahalanobis Distances .....	38
9. Normality Test for Acetate Concentrations in Strata A. ....	39
10. Lognormal Validation of Acetate Concentrations in Strata A.....	40
11. Butyrate Converted Distribution from Strata C .....	41
12. Acetate Population Comparison .....	45
13. Trends in PPM Analyte Concentrations .....	47
14. Trends in PPB Analyte Concentrations .....	47

## **List of Tables**

Table	Page
1. Physical Characteristics of PCE and Daughter Products .....	4
2. Calibration Table for External Standards.....	34
3. MDL for All Analytes (ppt).....	35
4. Influent Concentrations.....	35
5. Instrument Background Concentrations (ppb) .....	36
6. Blank Concentrations (ppb) .....	36
7. Organic Concentrations and Distribution Parameters.....	43
8. Inorganic Concentrations and Distribution Parameters .....	44
9. Organic Analyte Mean Comparison of Populations .....	46
10. Inorganic Analyte Mean Comparison of Populations.....	46
11. Possible Sources of Variability and Degree.....	50
12. Bias Factors for Organic Analytes .....	51
13. Bias Factors for Inorganic Analytes .....	51

Abstract

Chlorinated ethene's physical properties as well as ubiquitous state at DOD installations makes it a priority for innovative remediation efforts. Current techniques are expensive and time consuming to maintain. Constructed wetlands suggest an inexpensive and operational alternative to conventional technologies.

Sub-surface flow wetlands provide the anaerobic zones necessary to reduce the recalcitrant chlorinated solvents prior to anaerobic or aerobic mineralization of its daughter products. A vertical flow cell to include sequential sedimentary layers of two hydric soil lifts and a mix of hydric soil and woody compost was the subject of this investigation. This study focused on the statistical significance among the three constructed strata. Concentrations of mono-carboxylic acids and other anions are indicators of the reductive conditions necessary for remediation. Acid anion concentrations were expected to be higher in the assumed anaerobic strata of the constructed cell as a result of the fermentation of humic substances. Decreases in sulfate and nitrate were also expected over the upward flowing, wetland profile due to the reductive, anoxic conditions.

Evidence in this study validate these assumptions and suggest that constructed wetlands are a viable alternative to current remediation methods. Findings also suggest manipulation of the physical parameters such as strata depth, soil type, flow rate, etc...of a wetland could increase the cell's remediation effectiveness.



# AN ANION CHARACTERIZATION OF A CONSTRUCTED WETLAND USED FOR CHLORINATED ETHENE REMEDIATION

## **I. Introduction**

The purpose of this study is to characterize a constructed wetland used to remediate a plume of Perchloroethene (PCE) and Trichloroethene (TCE). Organic and inorganic analyte concentrations are expected to shed light on the dynamic relationships the system plays when these contaminants are introduced. This effort will focus on low-molecular weight, mono-carboxylic acids that are a result of biotic and abiotic processes occurring in the constructed wetland. Inferences will be made based upon statistical analysis among set populations of concentrations of ten selected analytes. Emphasis will be given to the role these organic acids play in the degradation of chlorinated ethenes.

Chlorinated solvents, such as PCE and its daughter products, have been used for decades for both civilian and military operations. Uses include, but are not limited to: degreaser, cleaner, carrier solvents, etc.... Due to their relatively high use in the past and still in the present, they are one of the most common contaminants faced in ground water remediation. Nine of the 20 most common chemicals found in ground water at Superfund sites are chlorinated solvents (National Research Council, 1997).

Chlorinated solvents were first produced in Germany in the nineteenth century; production in the United States began around 1906. Widespread use began during WWII (Pankow and Cherry, 1996). Use of these chlorinated solvents hit an all time high in the

1980's when VC was discovered as a carcinogen and its parent compounds (TCE and PCE) as possible carcinogens.

These chlorinated aliphatic compounds (usually PCE or TCE) were introduced into the groundwater by either dumping on to the surface or through leaking containers as from underground storage tanks (UST). Once in the vadose zone, these dense solvents would percolate through the zone and sometimes be trapped into void spaces or adsorbed to the surface area of soil particles. Due to their specific gravity (S.G.) and octanol/water partition coefficient ( $K_{ow}$ ), PCE and TCE could easily rest in these unsaturated areas for decades. Those molecules of solvent that make it through the vadose zone become globules in the capillary fringe. Once the plume of globules becomes significant enough to overcome the water's density, they slowly sink below the water table until they come to rest on an aquitard or some other barrier at the bottom of the aquifer. The plume mass will vary from site to site depending on the physical characteristics of the vadose zone, aquifer, and actual compound. The more reduced the form of chlorinated solvent, the more mobile it becomes.

Contamination by large quantities of chlorinated solvent can present several distinct problems, including gas-phase solvent in the vadose zone, sorbed solvent and residual DNAPL (Dense Non-Aqueous Phase Liquid) both above and below the water table, and dissolved-phase contamination that range from 3 to 30 liter/m<sup>3</sup> in unsaturated soils and from 5 to 50 liter/m<sup>3</sup> in saturated soils (Mercer and Cohen, 1990). Due to the slow and transport process below the water table, unique physical characteristics, and low water solubility these compounds are extremely hard to locate and remediate. Mobile

NAPL recovery typically recovers less than 10 percent of the total NAPL mass in a spill (Wiedemeier, 1997).

Not until the late 1970s were implications of our actions realized. Congress then introduced remediation steps under the passing of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in 1980. In 1986, Congress also passed the hazardous waste amendment to the Resource Conservation and Recovery Act (RCRA), which work towards the prevention of additional chlorinated solvents in the nation's groundwater. Legislation and the public's awareness of these toxic substances have dramatically increased the study of fate and transport and remediation of chlorinated solvents.

PCE is denser than water and is usually dumped at the surface as either a pure substance or as a mixture of other hydrocarbons. Contaminants such as chlorinated solvents are classified as NAPLs (non-aqueous phase liquids), due to their low solubilities but not immiscible as the name implies. Due to its relative weight, PCE and its daughter products are referred to as DNAPLs (the "d" signifies dense).

Over the course of decades, agriculture, industry, and government agencies have been dumping these DNAPLs into the ground with ignorance towards the environmental risk these substances impose. These substances have seeped into the ground and collected, for the most part, in plumes near the point source. The chlorinated solvents would then partition into the ground water, thus having a direct path into our drinking water. Their solubilities in water are so low, removal by dissolution can take centuries (Masters, 1997). The following table depicts characteristics of PCE and its daughter products (Norris, 1994):

**Table 1. Physical Characteristics of PCE and Daughter Products**

<i>Compound</i>	<i>Density, g/ml</i>	<i>Solubility, mg/l</i>	<i>Henry's Constant, atm</i>	<i>log<sub>10</sub>K<sub>ow</sub></i>
Tetrachloroethylene (PCE)	1.63	200	1100	2.88
Trichloroethylene (TCE)	1.4	1100	550	2.29
1,1-Dichloroethylene (DCE)	1.013	250	1400	0.73
Vinyl Chloride (VC)	Gas	1100	35500	0.60

Remediation of chlorinated solvents can be divided into three general categories:

1) technologies for solidification, stabilization, and containment; 2) technologies using biological and/or chemical reactions to destroy or transform the contaminant; 3) technologies which separate the contaminant from the contaminated media, mobilize the contaminant and extract it from the subsurface (National Research Council, 1997). Of these three, extraction from the subsurface is currently the most popular with in-situ technology utilization lagging far behind. In fact, EPA data through 1995 at Superfund sites show that only 1% of remediation efforts use *in-situ* technology. Even with all of the negative aspects of conventional pump and treat systems used for remediation of DNAPL chlorinated solvents, 93% of Superfund sites still use this technique (National Research Council, 1997).

One of the most common forms of *in-situ* remediation is that of natural attenuation using both abiotic and biotic means of degradation. While both play a role in the reduction and eventual mineralization of the organic compound, bioremediation is by far the most effective. Biodegradation is the most important destructive attenuation mechanism (Wiedemeier, 1997). Chlorinated aliphatic hydrocarbons may undergo biodegradation through three different pathways: through use as an electron acceptor,

through use as an electron donor, or through co-metabolism, where degradation of the chlorinated organic is fortuitous and there is no benefit to the microorganism (Wiedemeier, 1997).

When the chlorinated hydrocarbon is used as an electron acceptor this process is referred to as halorespiration. Certain anaerobes have the ability to gain energy from a carbon source and the chlorinated solvent in its biological functions. During this process, the chlorinated hydrocarbon is used as an electron acceptor, not as a source of carbon, and a chlorine atom is removed and replaced with a hydrogen atom (Wiedemeier, 1997). The evolutionary origin of dehalorespiring bacteria or other microbial types that appear to be well adapted to growth on chlorinated solvents is uncertain (Lee, 1998). This process has promising remediation applications as these special organisms have the ability to reduce PCE, a recalcitrant compound, to an innocuous form of either ethylene or ethane

The second biodegradation pathway is that where a chlorinated solvent is used as a source of carbon or electron donor for a microcosm. Under aerobic and some anaerobic conditions, the less-oxidized chlorinated aliphatic hydrocarbons (e.g., vinyl chloride) can be used as the primary substrate in biologically mediated redox reactions (Norris, 1994). Both aerobic and anoxic conditions can be conducive for microbial populations able to use chlorinated solvents as substrates, however tests have shown that aerobic conditions prevail. McCarty and Semprini describe investigations in which vinyl chloride and 1,2-dichloroethane were shown to serve as primary substrates under aerobic conditions (Norris, 1994).

The third process a chlorinated solvent undergoes during biodegradation is co-metabolism. Wiedemeier describes co-metabolism as the degradation catalyzed by an

enzyme or cofactor that is fortuitously produced by the organisms for other purposes (Wiedemeier, 1997). Co-metabolism is predominantly found in aerobic conditions, however anaerobic processes have been found. In aerobic zones, the most common cofactor among enzymes is that of monooxygenase. Methanotrophic bacteria containing monooxygenase and dioxygenase enzymes are widespread in nature, including aquifer environments. Vogel (1987) further elaborates that co-metabolism rates increase as the degree of dechlorination decreases. However, the fully chlorinated ethene PCE is resistant to degradation via this mechanism (Lee, 1998).

No matter the conditions, reductive dechlorination must be enhanced to efficiently remediate contaminated sites. Doing so will take innovative measures that go beyond natural attenuation or traditional treatment technologies. These innovative technologies must not only be attractive in their speedy recovery of the aquifer, but also in cost.

In a recent publication by the National Research Council (NRC, 1997) the Office of Management and Budget estimates the cost of remediation at contaminated sites owned by Departments of Defense, Energy, Interior, and Agriculture and the National Aeronautics and Space Administration will total between \$234 and \$389 billion over the next 75 years. The NRC also reports that the Department of Defense alone has an estimated 7,300 sites contaminated with chlorinated aliphatic compounds. With numbers as staggering as these and budgets unable to handle to total clean-up effort, novel approaches to remediation are essential. Natural wetlands have been proven an effective tool towards degrading PCE and TCE into innocuous ethylene or ethane (Lorah, 1999a). For groundwater contamination plumes discharging to wetlands, natural attenuation is a

promising *in-situ* remediation method that would keep the ecosystem largely undisturbed and be cost-effective [U.S. Environmental Protection Agency, 1997].

Wetlands are sometimes described as “the kidneys of the landscape” because they function as the downstream receivers of water and waste from both natural and human sources (Mitsch and Gosselink, 2000). If employed correctly both natural and constructed wetlands can become a cost effective measure in the remediation of chlorinated aliphatic compounds. Wetlands contribute significantly to the necessary conditions for reductive dechlorination. Not only do wetlands provide the necessary environment, but also their natural accessibility, applicability, and history make them a prime candidate for remediation technologies. Many hazardous-waste sites at military installations and at industrial facilities, however, are located near surface-water bodies where wetlands are a dominant part of the landscape (Lorah, 1999b). U.S. Environmental Protection Agency (USEPA) data show that 75% of all Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous-waste sites are located within 0.5 miles of a surface-water body (USEPA Region I, written communication, 1998).

Wetlands prohibit both electron donors and acceptors from inhibiting the bioremediation of chlorinated solvents. The ecology of wetlands allows a cyclical supply of substrate (source of carbon) and nutrients. Even though anoxic conditions dominate the reducing zones, wetland hydrophilic vegetation produce an aerobic rhizosphere capable of handling the less chlorinated hydrocarbons.

Success stories like those at the Aberdeen Proving Grounds (APG) in Maryland by Lorah (1999b) have launched significant research by both industrial and federal

agencies. The conclusion of this and other studies by Lorah (1999a) and Pardue (1993) is that wetlands are ideal environments for reductive dechlorination processes (Pardue, 2000).

While decomposing vegetation is a source of carbon for a lot of microorganisms in wetland soils, organic acids both function as by-products and substrates in the ecosystem. These acids can serve the casual observer as an indicator of biomass activity. Organic acids, especially acetate, are important products and substrates for diverse microbial processes, especially in anaerobic habitats (Seagren and Becker, 1999). In anaerobic environments, complex organic compounds can only be mineralized through the concerted activities of multiple, inter-dependent populations (Seagren and Becker, 1999). Thus, in these systems, continuous removal of reaction products by syntrophic populations is necessary in order to sustain the oxidation of complex organic compounds (Seagren and Becker, 1999).

Two of the major anaerobic processes are fermentation and methanogenesis. The fermentation of organic matter, also called glycolysis for the substrate involved, occurs when organic matter itself is the terminal electron acceptor in anaerobic respiration by microorganisms and forms various low-molecular weight acids and alcohols and CO<sub>2</sub> (Mitsch and Gosselink, 2000). Examples are lactic acid shown below.



Not only will organic acids like lactic and acetic give rise to the bioremediation efforts in different zones of the wetland, they can also classify the reducing traits of that zone. Acetate concentration measurements in sediments in which CO<sub>2</sub>, sulfate, or Fe(III)-reduction were the predominant terminal electron accepting processes (Lovely and



Phillips, 1986) suggest that a similar relationship may exist between the thermodynamics of the electron acceptor half-reactions and acetate concentrations in anaerobic environments (Seagren and Becker, 1999).

The purpose of this study is to determine an anion profile within an upward flow constructed wetland and relate that profile to hypothesized mechanisms of contaminant. The characterization presented in this thesis will hopefully supply remediation engineers with the data necessary to effectively and efficiently remediate PCE and TCE pumped from a contaminated aquifer. In conjunction with similar efforts on the same wetlands, this study will serve as benchmarks towards a cost and time effective means of recovery of aquifer systems.

### **Research Questions**

1. What low-molecular weight mono-carboxylic organic acids are most significant in each layer of the constructed wetland?
2. What inorganic anions are prominent in each layer of the constructed wetland?
3. Can concentration levels of the selected analytes suggest enhancements in design, construction, and overall efficiency of constructed wetlands used for this purpose?
4. Does the analysis suggest a change in microbial communities occurs as substrates move through the layers?

## **II. Literature Review**

While natural attenuation of chlorinated solvents is an option in the remediation of contaminated groundwater, the process is extremely slow. Decades could pass before concentrations reach the Maximum Contaminant Level (MCL) as prescribed by the EPA. Therefore, inventive approaches, like using constructed wetlands to intercept the plume of chlorinated aliphatic compounds are proven alternatives to the reduction of PCE and TCE from contaminated aquifers. Constructed wetlands can be engineered to provide the optimum environment for bioremediation.

The U.S. Army Corps of Engineers define wetlands as “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions” (Environmental Laboratory, 1987). Any wetland must contain three basic characteristics depending upon the growing season: hydrophytic vegetation, hydric soil, and hydrology.

### **Constructed Wetlands**

Using criteria from an authoritative source like the Corps of Engineers and parameters outlined from previous success stories, constructed wetlands can then be designed to induce microbial degradation. The designer(s) have the ability to make the wetland either a sub-surface flow (SSF) or a surface flow (SF) depending upon a desired hydrology. Both types offer environments that can provide conditions for remediation, however, the order at which they encounter oxygenated soils are opposite. The SSF has the advantage over SF in that anaerobic, highly reductive environments are introduced to

the VOCs first followed by an aerobic rhizosphere as the water enters from beneath. Anaerobic conditions have been proven to reduce more oxidized forms of chlorinated aliphatic hydrocarbons. Low-molecular-weight organic acids are frequently reported in oxygen-restricted environments because of the microbial decomposition of natural organic matter (Thurman, 1985). Acid concentrations in the anaerobic regions are expected to be higher than the top layer aerobic strata.

Particularly troubling are sites in which PCE, TCE, and DCEs reach aerobic zones in which they are essentially nondegradable under natural conditions (Gossett and Zinder, 1997). Chlorinated solvents such as PCE have been reduced to ethylene and ethane given the proper reducing, anaerobic conditions and time. No known microorganism can aerobically destroy PCE (McCarty, 1997a). Therefore, allowing contaminants to pass through anaerobic followed by an aerobic layer gives SSF constructed wetlands an edge versus SF in the remediation of VOCs.

Using such a design assumes that the extensive humic substances found in wetlands will be fermented in the sub-surface layers at significantly higher levels than in assumed aerobic strata near the surface. In the anaerobic regions, microorganisms will liberate organic acids during microbial metabolism under conditions of growth-limiting concentrations of high potential electron acceptors (White, 1990). Volatile fatty acids are the result of fermentation reactions and hence are elevated in concentrations in anoxic aquatic environments (Kramer, 1990). Organic acid production and consumption throughout a wetland mediate the processes necessary for biodegradation. The sources and reactions of organic acids are fundamental considerations for investigations of many natural environments and the processes that occur within them (Hedges, 1990).

Constructed wetlands are unique ecosystems that develop characteristics ideal for remediation. The behavior of the chlorinated solvent compounds in the field is the net result of various processes operating in concert (Pankow and Cherry, 1996). These processes include advection, dispersion, sorption, chemical transformation, biotransformation, and perhaps vaporization (Pankow and Cherry, 1996). Constructed wetlands allow the designer to manipulate these processes in order to optimize the degradation of the chlorinated aliphatic compound. The wetland can be built to manipulate all three characteristics of a wetland: hydric soil, hydrology, and hydrophytic vegetation. This trio works symbiotically and syntrophically to tolerate fluxes of contaminants. The soil will provide retardation giving the in-situ tool for natural attenuation. The plants facilitate with both providing aerobic environments in an anoxic conditions and as sources of carbon as they die and decompose. The hydrology creates the anoxic setting for particular wetland species to thrive and a source of media for contaminants. Controlling these parameters, hands the designer the power to influence the effluent in order to meet standards for possible receptors.

### **Biodegradation Pathways**

All three wetland characteristics have a direct effect on general type of microbial activity (methanogen, acetogen, aerobic, facultative anaerobic, etc...) and metabolic rate. If the hydrology is designed to completely inundate the hydric soil and vegetation, then anaerobic conditions will prevail over a wetland profile. However, these parameters cannot change the different microbial degradation pathways that exist in the reduction and hopeful mineralization of chlorinated aliphatic compounds: electron donor, electron

acceptor, and co-metabolic. The devised factors can only allow one or more of the paths to dominate in a constructed wetland.

### **Electron Donor**

When a chlorinated aliphatic compound is used as an electron donor (source of carbon), the microbial population gains energy from the process. Not all chlorinated ethenes have been shown to be food sources and only aerobic conditions have been witnessed in mineralization of the solvents. Less chlorinated ethenes (e.g. VC) have been shown in direct dechlorination under aerobic conditions. Rapid aerobic oxidation of 1,2-*cis* DCE to CO<sub>2</sub> was observed in bed sediment microcosms under aerobic conditions (Bradley and Chapelle, 2000). Bradley and Chapelle (1996) also show evidence of mineralization of vinyl chloride as an electron donor under iron-reducing conditions so long as there is sufficient bioavailable iron (III).

Most of these situations occur in aquifers that are electron donor limited and only with the less oxidized forms of chlorinated solvents. In contrast to reactions in which the chlorinated aliphatic hydrocarbon is used as an electron acceptor, only the least oxidized chlorinated aliphatic hydrocarbons can be used as electron donors in biologically mediated redox reactions (Wiedemeier, 1997). Investigations describe vinyl chloride and 1,2-dichloroethane as primary substrates under aerobic conditions (Norris, 1994).

However, with strong competition in an electron donor rich constructed wetland, the likelihood that microcosms in the rhizosphere (aerobic zone) will use chlorinated aliphatic compounds is low. The most probable scenario of biodegradation in the aerobic regions of a wetland is co-metabolic.

## **Co-metabolism**

Co-metabolism of chlorinated aliphatic compounds is defined as fortuitous degradation in which microorganisms receive no metabolic benefit. In aerobic environments, microcosms of methanotrophs will use methane as the electron donor and oxygen as the electron acceptor. Under these conditions, the methanotrophs will produce an enzyme known as methane monooxygenase (MMO). MMO then degrades the chlorinated solvent.

Methanotrophic bacteria containing monooxygenase and dioxygenase enzymes are widespread in nature (Lee, 1998). While inducible oxygenases have been known to partially degrade chlorinated ethenes as TCE, cis-DCE, and VC, the recalcitrant PCE is resistant to the aerobic co-metabolic pathway. PCE can be reductively dechlorinated, however through anaerobic co-metabolism.

Under some anaerobic conditions PCE is incompletely reduced to TCE or a DCE isomer. Many classes of anaerobic organisms (e.g., methanogens, acetogens, sulfate reducers) have been found to possess metal-porphyrin-containing cofactors that can mediate the slow, incomplete reductive dechlorination of PCE and TCE to (usually) DCE isomers (Gantzer and Wackett, 1991). Such co-metabolic dechlorinations undoubtedly are responsible for the incomplete, relatively slow transformations of chloroethenes observed at many field sites. The organisms that can mediate such processes are ubiquitous, but the process is sufficiently slow and incomplete that a successful natural attenuation strategy cannot completely rely upon it (Gossett and Zinder, 1997). However, by manipulating parameters of the constructed wetland, mineralization beginning with anaerobic co-metabolism of recalcitrant compounds is highly probable.

### **Terminal Electron Acceptor**

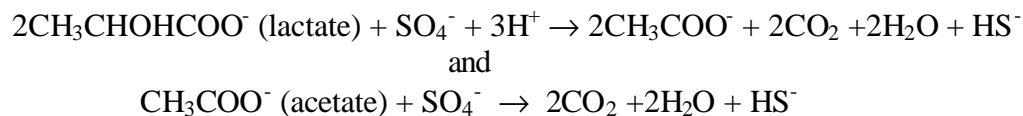
While most microorganisms compete for anaerobic electron acceptors for respiration (nitrate, sulfate, iron hydroxide, etc...), some utilize chlorinated aliphatic compounds for energy as a terminal electron acceptor. The utilization of chlorinated solvents in energy producing metabolism is known as halorespiration. Depending upon the species, these bacteria may produce *cis*-DCE as a final end product or may carry out complete dechlorination to ethene (Lee, 1998).

Some unique bacteria have the ability to reduce highly chlorinated ethenes such as PCE. Frequently, PCE and TCE persist for years without change, because electron donors required for halorespiration are absent (McCarty, 1997b). Some PCE-dechlorinating organisms appear versatile at using electron donors and acceptors, while others, most notably "*Dehalobacter restrictus*," "*D. ethenogenes*," and strain TT4B apparently can only use a single electron donor and only chlorinated aliphatic hydrocarbons as electron acceptors (Gosset and Zinder, 1997). Species such as these can work symbiotically in wetland environments where competition for electron donors is healthy. In cases where organic materials are present to provide the electron donors required for halorespiration, the complete destruction of PCE and TCE under anaerobic conditions involves consortia of many microorganisms working together (McCarty, 1997b).

### **Organic Analytes**

Low-molecular weight, mono-carboxylic organic acids play vital role in the pathways at which degradation is possible. Methanogenic bacteria can conveniently

supply these necessary low-molecular-weight organic compounds such as lactate and ethanol for sulfur-reducing bacteria: (Mitsch and Gosselink, 2000)



Some see organic acids as the tool necessary to predict bioremediation. Knowing the distribution of microbially-mediated redox processes is key to predicting the fate and transport of organic and inorganic contaminants in groundwater systems (Seagren and Becker, 1999).

The organic anion analytes of interest in this study are propionate, butyrate, lactate, acetate, and formate. Previous research of organic acids has shown both lactate and acetate to dominate the total acid concentrations in a wetland. Unusual signs of others may be correlated to further research and provide a valuable monitoring and predicting tool. Cizkova et al (1999) found acetic and lactic acids in various wetlands at greater than 50% of the total mono-carboxylic acid concentrations detected.

Fermentation of humic substances and organic acids is expected in the anaerobic strata of B and C that will enhance the reductive conditions necessary for the biodegradation pathways shown above. Fermentation of butyrate and propionate can lead to metabolites of acetate, hydrogen, and bicarbonate, which serve as precursors to methanogenesis (Van Lier, 1993). General agreement exists that anaerobic conditions that support methanogenesis are needed to reduce PCE. Freedman and Gossett (1989) found that PCE reduction to ethane was possible given significant attenuation under methanogenic conditions. Mono-carboxylic acids lay the foundation for reductive



environment. Their ubiquitous nature in wetlands and integral component to the processes conducive to bioremediation suggest the need for this research.

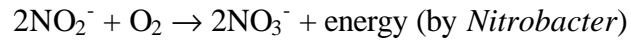
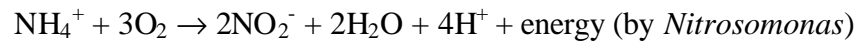
### **Inorganic Analytes**

Concentrations of chloride, fluoride, nitrate, nitrite, and sulfate can provide valuable insight to the ecology of the cell. Some of these analytes are expected naturally to some degree in both the wetland and in the aquifer that feeds cell #1. However, the trends that each take as they progress through the wetland are of particular interest.

Chloride concentrations have been used as a tracer to quantify mass transfer processes and an estimator of evaporation in wetlands (Hayashi, 1998). Chloride's conservative nature in most terrestrial environments and use in the contaminants make it an analyte of interest. Nitrates and sulfates are commonly used electron acceptors for many cultures of anaerobic microorganisms.

Their changes in concentrations paint a picture of the metabolic reactions and reductive conditions that exist throughout the wetland. Constructed wetlands are effectively used for nitrate removal. Wetlands have two environmental characteristics that promote denitrification: (1) the sediments are anoxic, a requisite condition for denitrification, and (2) plant growth provides a source of carbon fuel (Ingersoll and Baker, 1998). Inorganics such as nitrates and sulfates have a correlation to the organic acid amounts seen in wetlands. Cozzarelli and others(1994) state that low-molecular-weight organic acid concentrations are controlled, in part, by the presence of electron acceptors available for microbially mediated electron transfer reactions. Cozzarelli adds that the depletion of electron acceptors leads to accumulation of aliphatic organic acids in anoxic groundwater.

Nitrite concentrations can give indications on the nitrification and denitrification processes prevalent in the wetland. Mitsch and Gosselink (2000) demonstrate the nitrification of ammonium by *Nitrosomonas* and *Nitrobacter* where the ammonium is transferred to nitrate:



Nitrification can also occur in the oxidized rhizosphere of plants where adequate oxygen is often available to convert the ammonium nitrogen to nitrate nitrogen (Reddy and Graetz, 1988). Limited nitrification in the top strata is expected due to the timing of the study (January 2002).

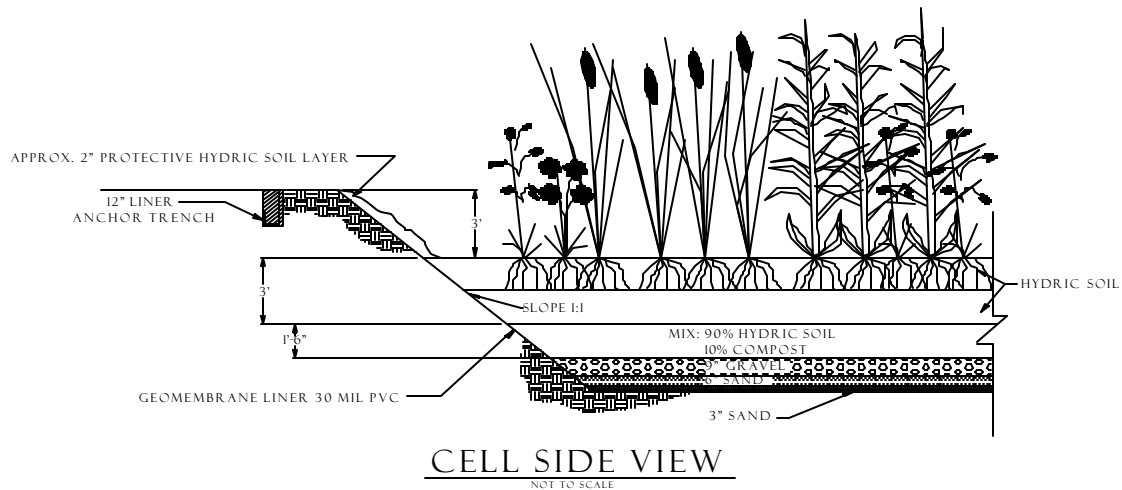
### **III. Methodology**

#### **Overview**

The purpose of this study is to construct a profile of the different anion concentrations outlined in chapter two by obtaining representative water samples from the soil matrix over three strata in order to gain an understanding of the biochemical dynamics of a sub-surface flow constructed wetland. Water samples will be drawn from a constructed wetland located at Wright-Patterson Air Force Base, Ohio. Following sample collection, preparing and analyzing of representative water samples will be conducted nearby at an AFIT environmental laboratory.

#### **Constructed Wetland**

Two separate wetland cells were completed in September of 2000. Each cell is fed PCE contaminated groundwater from an adjacent well. A cell (approximately 120' X 60') consists of three parallel supply lines running the length lying on a bed of sand, geomembrane, and another layer of sand. Crushed gravel covers the supply lines followed by three lifts. In cell #1 a mixed layer of 90% hydric soil and 10% compost (wood chips) tops the gravel layer. Two successive layers of hydric soil lifts then follow. In cell #2, the scenario is similar except that an iron rich middle stratum is sandwiched by two equally thick hydric soil strata. The following figure gives an as-built of cell #1, since it was the focus of this study due to time constraints:



**Figure 1. Constructed Cell Profile**

### **Wetland Preparation**

Researchers of cell #1 developed a sampling plan prior to any sampling and analysis. In order to completely characterize the wetland over all three dimensions of the wetland cell, researchers chose a sampling grid. By assuming all three lifts to be homogeneous throughout with the top as the rhizosphere, the wetland is comprised of three target populations for statistical analysis. Inferences will be based upon these population units for this study.

### **Sampling Plan**

In order to obtain a representative water sample from the soil matrix a Solinst model 6150 piezometer was chosen as the means necessary for water extraction. A representative unit is defined as one selected for measurement from the target population in such a way that it, in combination with other representative units, will give an accurate picture of the phenomenon being studied (Gilbert, 1987). Four research projects concurrently shared the wetland; three of the four studies combined resources to develop a comprehensive plan that utilized a limited number of piezometers while maintaining

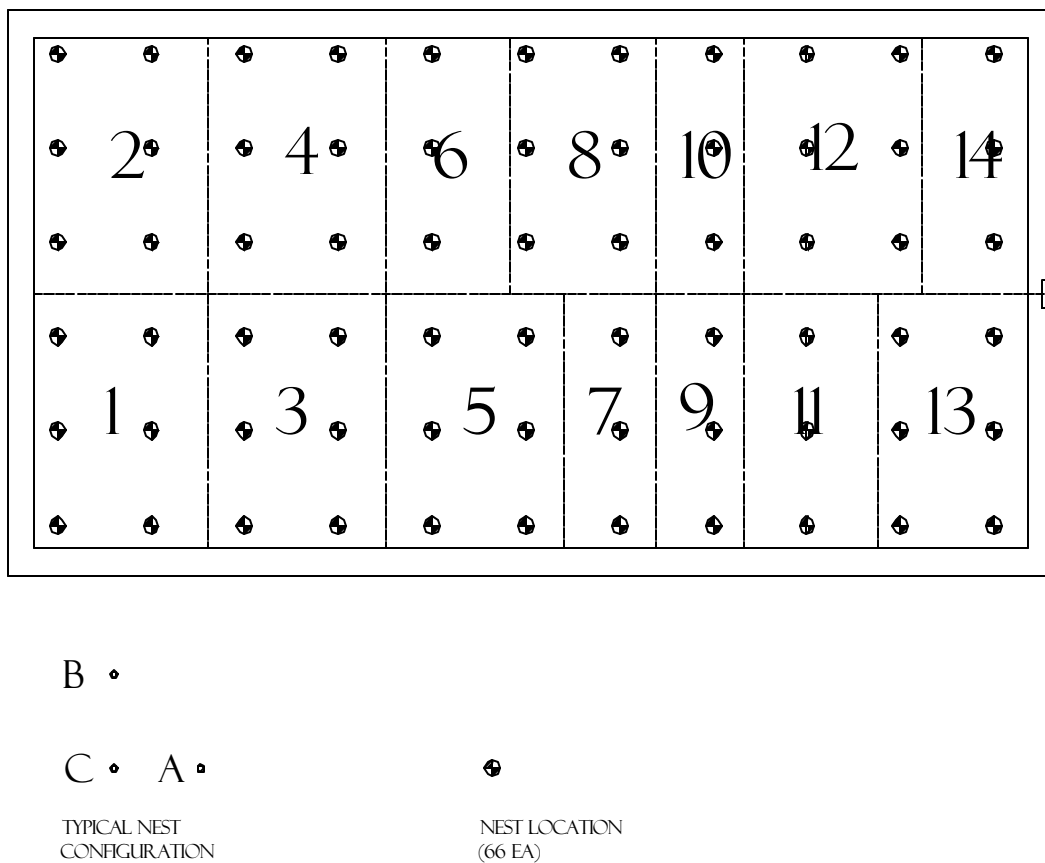
quality assurance standards for all three. Project one, led by Wright State University (WSU), studied the interactions of multiple, yet typical wetland plant species. Two observed the changes in piezometric head throughout a wetland, based on the three constructed lifts (Entingh, 2002). Hydraulic conductivity, head characterization, and coefficient of storage are only some of the outcomes from project two's research. Project three's objective was to look at the wetland remediation efficiency of chlorinated ethenes throughout (Opperman, 2002). Water samples would be taken in accordance with a combined plan and analyzed with a gas chromatograph to determine the concentration levels of PCE and all of its daughter products. Project four's study encompassed the research outlined in this thesis.

Researchers agreed that the placement of 66 nests of piezometers in a grid per strata would sufficiently characterize the wetland. Using this concept, cell #1 was prepared by driving a total of 198 piezometers. Systematic sampling allowed easier marking and placement of sampling points while providing uniform coverage of the three target populations. Disadvantages to this plan include missing unsuspected periodicities over time and/or space and misleading estimates of the population mean and total (Gilbert, 1997). Sampling geometric patterns provided by the grid could possibly hide or miss concentration patterns in wetlands that fit an offset pattern not consistent to the one used. A sampling distribution of each piezometer was taken in order to minimize periodicities and misleading statistical analyses. A minimum of three separate samples over a one month period is taken for each sampling point. The sampling grid created can facilitate future research to estimate long-term trends, define seasonal cycles, or forecast pollution concentrations (Gilbert, 1997). The grid allows for future correlations among

other cells and plots and gives the ability to infer on concentration levels throughout the wetland.

### Piezometer Placement Procedure

Surveys were conducted by the 88<sup>th</sup> Civil Engineering Squadron to align the grid prior to piezometer placement. Figure 2 depicts the piezometer placement and plots throughout the wetland.

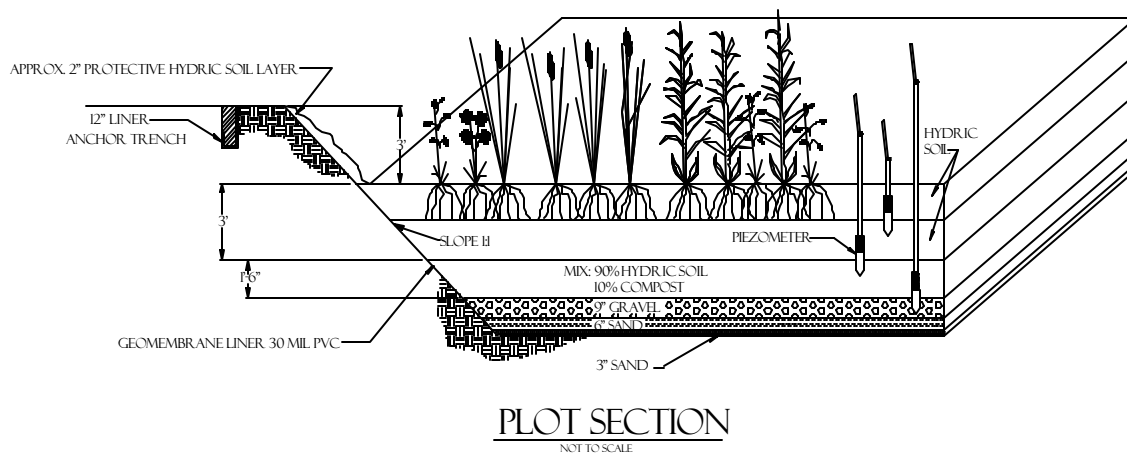


**Figure 2. Wetland Plots and Piezometer Placement**

WSU students prepared cell #1 with specific plant species for its individual research in the fall of 2000. Appendix A gives each plant species planted per plot.

Three test piezometers were driven to midpoints of the three strata prior to assembly to determine the maximum height over all populations for pieziometric head capture and measurement. With an estimated 10 gal/min inflow, the pieziometric head above wetland grade for strata's C through A were 24 inches, 18 inches, and 12 inches respectively.

Each piezometer was assembled based on pieziometric head, marked, and driven to a depth of eight inches below a sampling location at midpoint of the desired strata with a 25-pound driver. The piezometer assembly contains a pointed metal sheath for ease of pounding into the soil matrix. Once the desired level (plus 6 inches) was achieved, the piezometer was pulled back 6 inches from the sheath thus exposing the screen area to the adjacent soil from which a sample would be taken. Each nest contained one piezometer for each population at 90 degrees and on one-foot centers. Researchers placed bentonite at the grade as a seal to minimize vertical flow up the piezometer tubing. Such action would reduce the contaminated water's retention time in the wetland and could ultimately reduce the wetlands remediation efficiency. The following figure illustrates a typical nest in a plot:

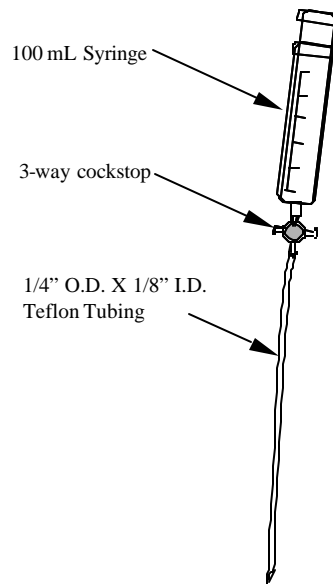


**Figure 3. Typical Nest Among Stratum**

## Sample Extraction

Researchers performed tests on two accepted methods for sample extraction: ISCO VOC Sampler and Solinst Peristaltic Pump. One procedure and equipment set would be chosen in order to keep consistent sampling procedures in all areas of study and to reduce cost. The peristaltic was abandoned due to the adsorption properties of its flexible silicon tubing and to the potential loss of VOC analytes due to degassing by changing partial pressures in the system (Wilson, 1995). Exchanging check-valves for cap and septums (exposing to air), and the shear weight and awkward configuration in a wetland contributed to the elimination of the ISCO VOC sampler.

A syringe-tube assembly provided minimal sorption and offered fine-tuned control of purge and sampling rates while minimizing time and work surface area in the wetland. The assemblage is shown in Figure 4.



**Figure 4. Extraction Assembly**



The method called for forcing a ¼” Teflon tubing down the 1/2” Teflon piezometer tubing until breaching the screened area. At the point where the 1/2” Teflon tubing intersects the screened portion a small lip can block passage of the tubing. To penetrate this area the tubing was frayed and cut at an angle. Repeated, forceful movements were sometimes required to penetrate this area.

Once in place, the piezometer was purged completely. The purpose of the purging stage is to avoid sampling from stagnant water. The piezometer’s original construction hinders vertical flow with screens located only on the horizontal axis. Horizontal flow is negligible in a sub-surface vertical flow constructed wetland, suggesting the need to remove stagnant water that seeps in horizontally through the screens. EPA Method SW846 Chapter 11 recommends purging three casing volumes before sampling.

Biotic and abiotic processes effecting stagnant water could bias analytical results that are not indicative to the adjacent water matrix. MacGowan and Surdam (1994) found a 15% reduction in acetate concentrations from a 1220-hour stagnant solution. Errors introduced through improper purging of stagnant water were found to be greater than errors associated with sampling mechanisms, tubing, and construction materials (Wilson, 1995).

Purging the piezometer seemed an inevitable step in the procedure. However, during testing of the assembly the flow in strata A & B were significantly slower than that in the bottom layer (strata C), not allowing three purges followed by an immediate sample. Piezometers in these layers were labeled candidates for development. Monitoring well development is an attempt to remove fine particulate matter, commonly clay and silt, from the geologic formation near the well intake (EPA 600/4-89/034, 1989).

If particulate matter is not removed, as water moves through the formation into the well, the water sampled will be turbid, and the viability of the water quality analyses will be impaired (Aller, 1989). An investigation was completed on the recovery rates of each piezometer during the month of November, 2001.

### **Piezometer Water Recovery**

Due to compaction from construction, recent disturbance of piezometer placement and wetland vegetation planting it was not uncommon to see the well recovery rates vary dramatically not only from strata to strata, but across the surface area of the cell. Recovery rates were taken at all sampling points to establish a purging procedure in order to obtain a water sample that is from the soil matrix in a “timely” manner.

The bottom strata (C) displayed no problems with recovery and could be purged and sampled during the same procedure. After observing and recording the recovery of sampling points in strata's A and B, it was determined that those piezometers that could not meet a recovery rate of 3.0mL/hr would be developed by surge pumping and purging using existing wetland surface water. This method of development included purging the piezometer, then immediately surging with a peristaltic pump. The process was repeated three times from each piezometer selected for development. 3.0mL/hr was chosen as the benchmark to allow discarding the first 20mL during extraction and a sampling volume of 50mL in the syringe before transferring into 40mL vial following a complete purge twenty-four hours prior.

Appendices D and E show the recovery rates of all sampling points in A & B before and after development. Ten piezometers in strata B initially fell below the

3.0mL/min standard, while A contained twenty-six. After development only two piezometers could not meet the recovery rate standard.

A purging-to-sampling elapsed time of twenty-four hours was initially chosen to ensure consistency among study areas. Laboratory hardware problems and software familiarization pushed back an original sampling and analysis effort of late November/early December 2001 to January 2002. During this lay-period, other researchers continued to develop and take samples, thus allowing the sampling points to mature and produce much higher recovery rates. The rates improved so much that a “timely” purge to sample recovery time shrunk to approximately two hours (vs. twenty-four).

When temperatures allowed, each strata was purged completely then sampled beginning with the first purged piezometer, thus allowing two hours of recovery. In all but five of strata A & B, 70mL + was attainable over this recovery period and only one piezometer could not be sampled due to misplacement. The five extremely low-flow sampling points were given enough recovery time to sufficiently fill the 40mL vial.

### **Sampling Procedure**

The sampling tubing was placed back into the piezometer following two hours of purging all piezometers in a particular stratum. The first 20mL in the syringe was discarded by turning the cockstop so as to keep a vacuum in the line while at the same time ridding the syringe of first 20mL. This step is part of the procedure for two reasons: 1) it primes the line to keep air from reaching the sample and 2) in between samples the line and syringe are flushed with DI water, this step keeps the sample from being diluted with residual DI water in the assembly. After discarding, approximately 50mL is pulled

into the jumbo syringe. At which time the cockstop is again turned to allow 40mL+ to fill a 40mL vial. As the strata was sampled, all filled vials were maintained in an ice bath cooler before transporting to the laboratory for sample preparation so as to minimize any biodegradation or other abiotic processes in the sampling vials.

### **Sample Preparation**

Once the samples were retrieved from cell #1, they were taken immediately to the laboratory at AFIT for preparation. Once at the lab, 5mL were drawn from the 40mL vial and then filtered using a 0.45  $\mu$ m syringe Teflon membrane filter into a Dionex disposable 10mL autosampler vial. A head space was required for the autosampler vial per manufacturer instructions. Filtering reduces interference among other organic compounds. Water soluble organic compounds can sometimes co-elute with organic acids and yield system peaks that interfere with organic acid detection (Chen, 1996).

If the samples could not be analyzed within twenty-four hours from extraction, the samples were maintained in an ice water bath until being analyzed, but not to exceed one week from extraction. A laboratory study showed these acids disappeared using a nonsterile organic-rich sample in 28 days (Kramer, 1990).

The 40mL extraction vials were cleaned with a 1% Liquinox solution for twenty-four hours and then rinsed in a bath of DI water for another twenty-four hours before being dried and used again for sample extraction. All sample waste from transferring and analysis was disposed as hazardous waste. The 10mL autosampler vials were discarded upon drying, thus allowing any residual chlorinated ethenes to volitalize. All syringe filters used in this procedure were discarded for each sample to avoid cross-

contamination. The equipment and procedure used for sample preparation can be seen in Appendices B and F.

## **Analysis**

Recent literature has proposed the use of ion exchange chromatography as the instrument of choice for organic acid qualitative and quantitative measurements. Ion exchange chromatography has proven to be more efficient and sensitive versus ion exclusion. A Dionex Ion Chromatograph (IC) system was chosen for the analytical portion of this study.

### **Instrumentation**

The Dionex 600 series IC system consisted of an EG40 Potassium Hydroxide Eluent Generator, GP50 Gradient Pump, AS50 Autosampler, CD25 Conductivity Dectector, 4mm self-regenerating Ultra Suppressor (used in recycling mode), and thermal compartment housing an AG-11 guard column and AS-11HC separating column. As shown in Figure 5, the gradient pump pushes De-Ionized (DI) water and eluent at concentration levels set by the program shown in Appendix E into an injection port. At the injection port, a loop is loaded with a 10 $\mu$ L wetland sample where it then passes through a guard column. The guard column protects the separation column from particulates that could permanently damage it and allows more effective separation of peaks. Once the sample is in the high capacity separation column, the hydroxide ion comes into competition with the analyte anion as it partitions from the mobile to stationary phase and then back to the mobile phase, thus allowing the different analytes to separate before entering the suppressor. The competition role that the eluent plays allows analytes that would normally take longer to be seen in the detector to push through the

column and on to the detector much sooner due to the analyte's partitioning coefficient once in the column and/or relative molecular size. Once in the suppressor, the analyte and eluent pass through cation exchange membranes where the  $K^+$  ion passes through to form KOH and  $H_2$  from DI water in contact with a cathode. At the same time,  $H^+$  ions are passing through another cation exchange membrane to form  $H_2O$  with the hydroxide ion in the eluent. Thus leaving only analyte and water to the conductivity detector allowing a lower baseline and detection limit. The procedure and equipment list used during the analysis of this research can be found in appendices C and G.

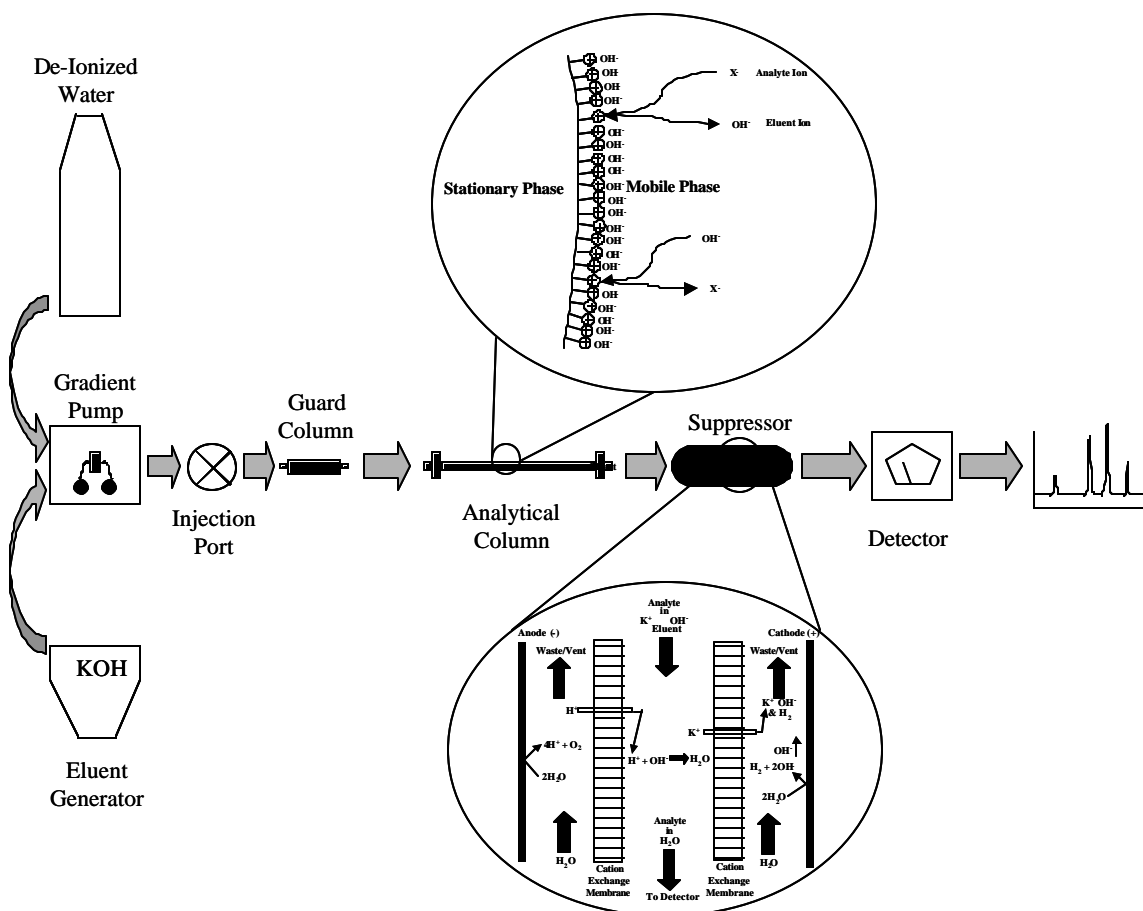


Figure 5. Ion Chromatography Flow Diagram

## **Software Programming**

After several qualitative trials, a method was developed that varied the eluent concentration at a flow rate of 1.50mL/min in order to get identifiable separation of peaks among the mono-carboxylic acids. The method calls for 10 $\mu$ L of sample to be injected with 1mM of KOH eluent at time 0.0 minutes. The eluent concentration then ramps from 1 to 8mM of KOH after 8.0 minutes and again from 8 to 30mM of KOH from 8.0 to 28.0 minutes. The last ramp of KOH concentration happens from 28.0 to 38.0 minutes with values of 30 to 60mM respectively. After 38.1 minutes the KOH concentration reduces to 1mM until the 41.5 minute mark for the system to re-equilibrate. While sulfate proved to be the last analyte at 23.550 minutes, high KOH concentrations produce undesirable conditions in the column for any residual analytes and are a critical portion of the analysis procedure. A blank sample is run prior to each batch of prepared samples. Appendix H shows the program used by the Dionex PeakNet 6.30 software to control the major components and parameters of those components during analysis.

An injection loop of 100 $\mu$ L allows calibrations to be performed by increasing injection volumes of standards prepared in the laboratory. Dionex PeakNet 6.30 software constructs calibration curves based upon developed external standards and can apply these curves to a sequence of samples giving identification and concentrations upon sequence completion. Detection parameters must be prior adjusted to assure confidence in the calibrated results.

## **IV. Results**

Dionex PeakNet 6.30 provided the compilations necessary to calibrate and validate all chromatograms. Quantitative measurement reports were copied into JMP 4.0 software for statistical analysis. JMP 4.0 allows visual interpretation of the data's unique distributions, assessing outliers, comparing means and variances, testing significance by strata or plot, and gaining confidence in methodology.

### **Standards and Calibration**

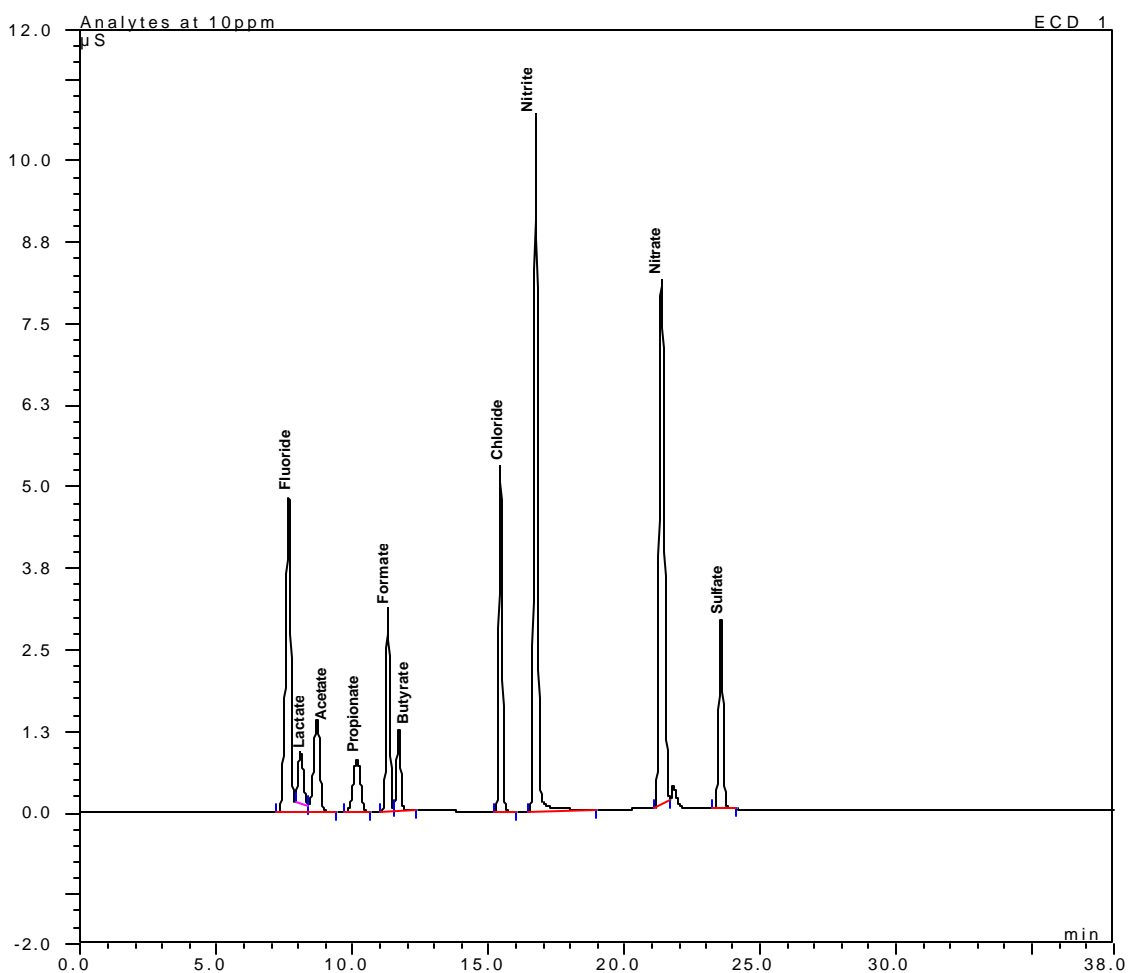
Liquid standards used in the IC were either diluted from an aqueous form or dissolved from a solid salt. Stock solutions from solid salts were first produced by computing the mass (by weight) of salt needed in order to form a 10,000 parts per million (ppm) solution. Dilutions produced the necessary concentrations of each analyte. The Dionex system detects anions and not their state in solution or salt, therefore each standard was prepared based on its anion base.

PeakNet 6.30 created calibration curves using a multi-point linear calibration series. The Dionex system is set up with a 100 $\mu$ L injection loop. PeakNet takes advantage of a large loop size by increasing sample injections of 10 $\mu$ L sequentially to receive a calibration range. An example would be to prepare a 10ppm standard, inject 10 $\mu$ L into the 100 $\mu$ L loop for the first run; on the second inject 20 $\mu$ L; on the third, increase the injection to 30 $\mu$ L. PeakNet then allows manipulation of the standards to show that run one contained 100ppm, run two—200ppm, run three—300ppm, etc.... This series saves time for a time restrictive study. However, due to driver problems in



the software, increasing injections resulted in less desirable regressions and interference among chromatogram peaks.

The software reports each analyte of a particular sequence in a spreadsheet format to convert to statistical programs. However, in order to utilize this function external standards were created using all analytes of interest. Test samples were run to find the qualitative retention times of interest and quantitative ranges for calibration. Figure 6 demonstrates the typical peak characteristics. From the figure, the inorganic anions provide much higher peak resolution and separation compared to the mono-carboxylic acids.



**Figure 6. Chromatogram of Analytes at 10ppm**

Test samples confirmed calibration ranges to be 1-100ppm for most inorganics and 1ppb-1ppm for organics. Exceptions were found with Fluoride, Nitrate, Nitrite, and Lactate. Each pushed the envelop of their respective ranges. External standards of all anyalytes were prepared and analyzed with concentrations ranging from 100ppm to 1ppb. PeakNet can disable certain standards for calibrating purposes. This function was applied to present the following calibration table.

**Table 2. Calibration Table for External Standards**

Retention Time (min)	Analyte	Calibration Range	% Correlation Coeff.	Offset	Slope
7.58	Fluoride	1ppb-1ppm	99.9975	0.0000	0.1177
8.08	Lactate	1ppb-1ppm	99.8849	0.0000	0.0175
8.66	Acetate	1ppb-10ppm	99.9205	0.0000	0.0383
10.15	Propionate	1ppb-1ppm	99.9769	0.0000	0.0237
11.30	Formate	1ppb-1ppm	99.7334	0.0000	0.0531
11.70	Butyrate	1ppm-1ppb	99.3483	0.0000	0.0324
15.45	Chloride	1ppb-100ppm	99.9991	0.0000	0.0682
16.75	Nitrite	1ppm-1ppb	99.9991	0.0000	0.1673
21.43	Nitrate	1ppm-100ppm	99.9910	0.0000	0.1789
23.50	Sulfate	1ppm-100ppm	99.9995	0.0000	0.0522

Original calibrations curves allowed offsetting. However, when area counts were applied to the curve's formula negative concentrations appeared, despite positive area counts. Per manufacturer's instructions the calibrations were forced through the origin. No offset typically drives less desirable correlation coefficients. However a minimum 99.3% correlation coefficient was attainable.

### Method Detection Limit

Both manufacturer and data concluded Method Detection Limits (MDL) in the parts per trillion (ppt). The Code of Federal Regulations (CFR) defines the MDL as the minimum concentration of a substance that can be measured and reported with 99%

confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte (40 CFR 136, Chapter 1). Part 136 of Title 40 CFR gives a procedure for determining MDL. Except for taking a minimum of seven aliquots, all steps were adhered. Six standards at 50ppb and 1ppb were used along with a t value at .99 of 4.032. Table 5 summarizes the MDL for each analyte.

**Table 3. MDL for All Analytes (ppt)**

Acetate	Butyrate	Formate	Lactate	Propionate	Chloride	Fluoride	Nitrate	Nitrite	Sulfate
20.04	248.3	168.8	25.01	19.30	11.47	3.237	228.1	2.674	250.2

### Background and Blanks

This study acknowledges two backgrounds of interest: 1) influent into the constructed wetland as and 2) de-ionized (DI) water as “instrument background.” Sparse to non-detectable organic acid concentrations can be seen in both. However the groundwater influent contain significant levels of inorganics. Table 4 shows the arithmetic averages of three separate analyses for the influent. Using the same method for influent, Table 5 gives concentrations for instrument background.

**Table 4. Influent Concentrations**

Acetate (ppb)	Butyrate (ppb)	Formate (ppb)	Lactate (ppb)	Propionate (ppb)	Chloride (ppm)	Fluoride (ppb)	Nitrate (ppm)	Nitrite (ppb)	Sulfate (ppm)
0.96650	0.71719	7.5997	15.553	1.0386	78.717	158.89	3.4439	2.0224	50.729

**Table 5. Instrument Background Concentrations (ppb)**

Acetate	Butyrate	Formate	Lactate	Propionate	Chloride	Fluoride	Nitrate	Nitrite	Sulfate
0.382176	N/D	1.26535	1.73703	0.504398	6.05990	N/D	2.78141	0.115826	380.324

DI Blanks, testing methodology procedures from cleaning, transport of samples, to analysis, were as follows: Cleaned 40mL vials were filled with DI water and brought to the constructed wetland on three separate occasions. The blanks were treated in the same manner as test samples described in Chapter III. Traces of most analytes were expected due to concentrations found in the same DI water shown in Table 5. The following table outlines the analysis of field blanks.

**Table 6. Blank Concentrations (ppb)**

Acetate	Butyrate	Formate	Lactate	Propionate	Chloride	Fluoride	Nitrate	Nitrite	Sulfate
16.1717	N/D	N/D	219.271	N/D	322.113	1.05751	50.8176	0.279367	543.192

Table 6 shows noteworthy changes from Table 5. The considerable amounts are most likely a result of faulty techniques in the methodology and should be noted for follow-on work in this area. One consideration could be the cleaning of sampling vials.

MacGowan and Surdam (1994) suggest cleaning sampling vials with a pre-wash of 1:10 nitric acid: distilled water versus the 1% solution of Liquinox used in this study.

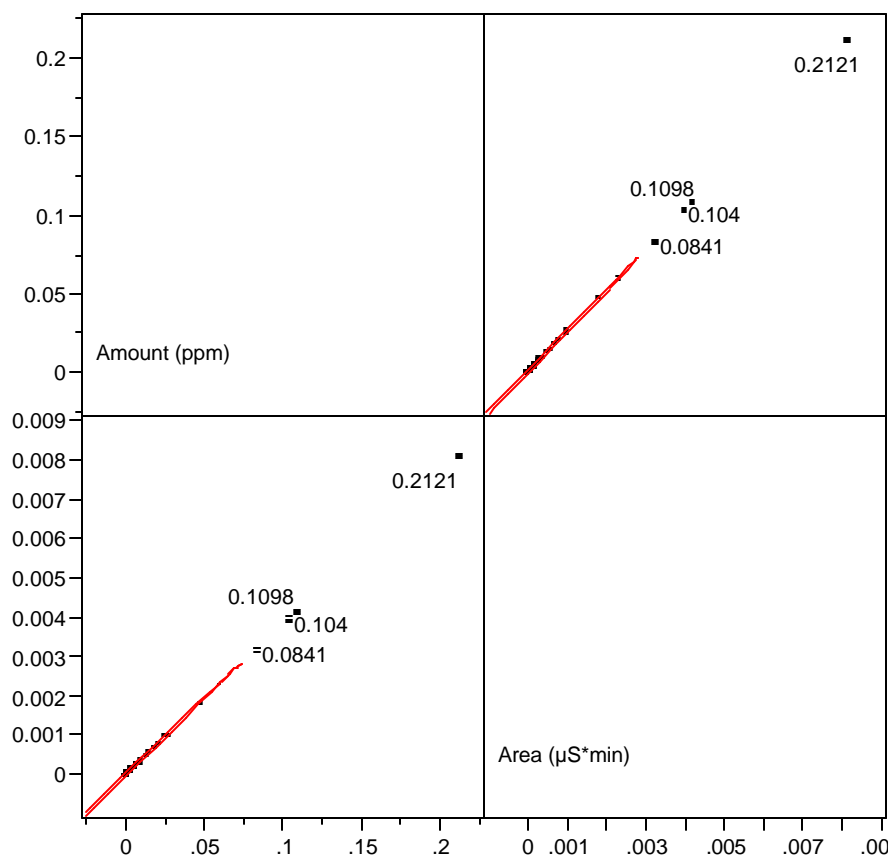
### **Statistical Analysis**

As stated in Chapter III, target populations were defined as the three strata in the constructed wetland. JMP 4.0 and Microsoft Excel were employed to run statistical

analysis of raw data reported by the Dionex IC. Appendices I through AV illustrate the data obtained from a typical PeakNet software report.

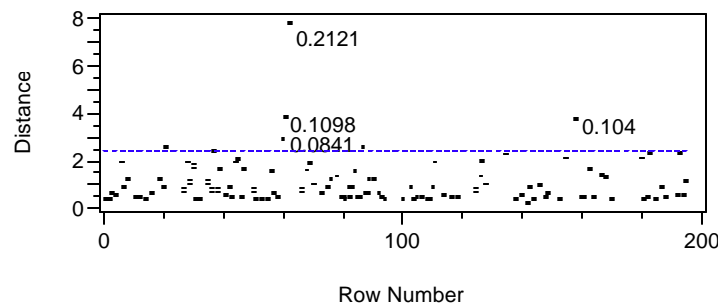
## Outliers

JMP performed a multivariate outlier analysis on all data per target population. The analysis included providing a density ellipse of correlated fields used for calibration: Area ( $\mu\text{S} \cdot \text{min}$ ) and Amount (ppm). A 95% interval was then applied to the scatter plot matrix. All points falling outside the interval were labeled as JMP outliers. Data marked with an asterisk and outlined in bold identifies those chosen by this method.



**Figure 7. Outlier Scatter plot Matrix with 95% CI Ellipse of Strata C Acetate Amounts**

Figure 7 demonstrates a typical scatter plot matrix with interval ellipse. JMP can also draw an F quantile reference line that shows an estimated distance that contains 95% of all points called the Maholonabis outlier distance plot. This test validates the use of the scatter plot matrix method for outlier determination. Figure 8 shows the same data using the Maholonabis plot. Notice that the four selected outliers in Figure 7 are confirmed in 8.



**Figure 8. Outlier Analysis, Strata C Acetate Using Mahalanobis Distances**

### **Outlier Hierarchy**

Following identification, outliers were then compared qualitatively and quantitatively for exclusion from the population. If no plausible explanation for an outlier can be found, the outlier might be excluded (Gilbert, 1987). Outliers for this data set were excluded based upon the following hierarchy.

- 1.) Is the identified outlier similar to other quantitative measurements from the same piezometer?
- 2.) Are similar concentration levels found in the adjacent area?
- 3.) Does it support a trend in the population?
- 4.) Can the outlier be explained from unique phenomena or changes in sampling and analytical methods?

Appendix AW identifies all outliers excluded from each population using the hierarchy above.

## Distribution of Data

Using sixty-six sampling points per population, and providing a sampling distribution for each, predicated a hypothesis for normal distribution over all analytes per the central limit theorem. However, approximately fourteen of the thirty distributions fit a lognormal curve while the remaining showed random distributions. The skewness of the data would not allow an unbiased estimator of the mean and all other parameters of interest assuming a normal distribution. Devore (2000) states that if a random sample from a distribution for which there are all positive values exists, and  $n$  is sufficiently large, the product of the data set has approximately a lognormal distribution.

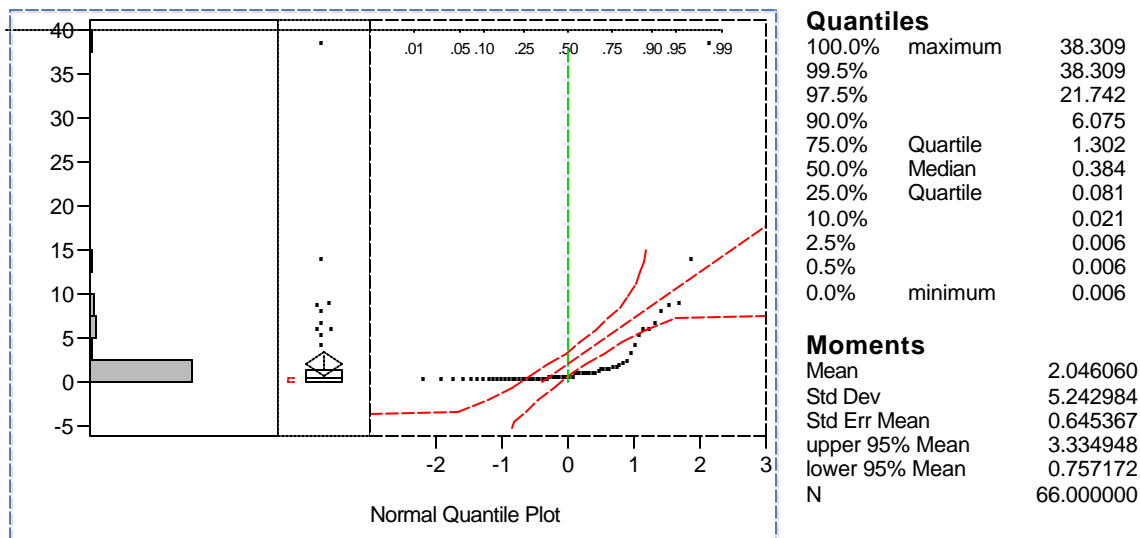
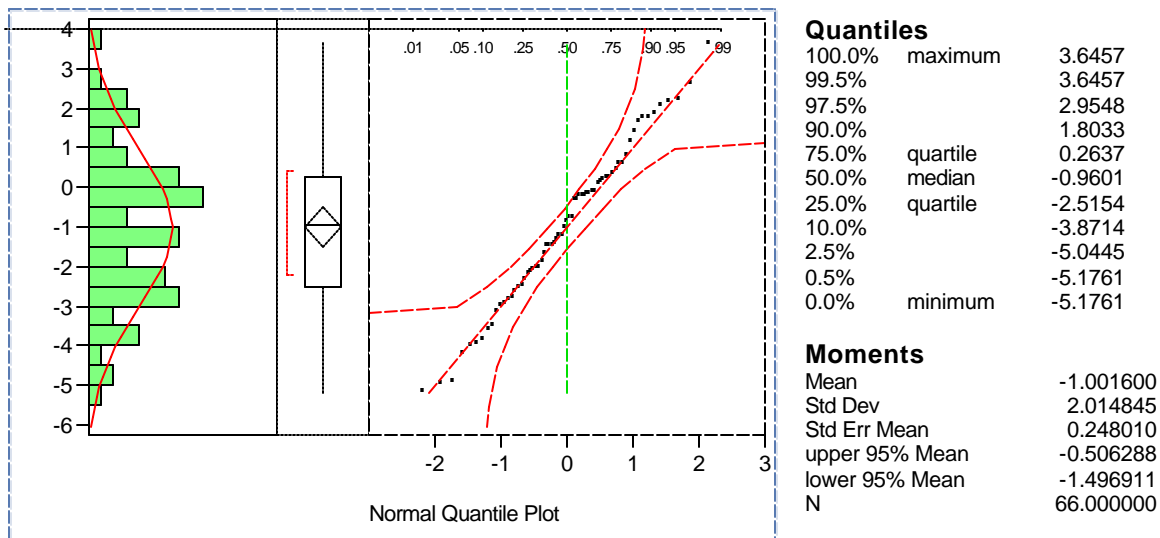


Figure 9. Normality Test for Acetate Concentrations in Strata A.

A null hypothesis stated that each analyte over a single population fit a normal distribution. JMP 4.0 software compiled a histogram with box and whiskers plot and a normal quantile plot to reject the null hypothesis of normality. Figure 9 demonstrates this test of normality. Both the histogram and normal quantile plot give visual evidence that the acetate concentrations of each sampling point in the stratum do not fit a normal distribution.

To determine if the skewness of the histogram met a lognormal distribution, the natural log of each piezometer concentration was computed for the same analysis. Figure 10 validates a lognormal distribution of the same data.



**Figure 10. Lognormal Validation of Acetate Concentrations in Strata A**

From the figure, by taking the natural log of the data a normal distribution was seen not only by the histogram, but also from the normal quantile plot. Normal distributions follow a straight line within confidence intervals when fit to the probabilities of the data set and then can be used to estimate  $\mu$  (Gilbert, 1987). The mean and standard deviation



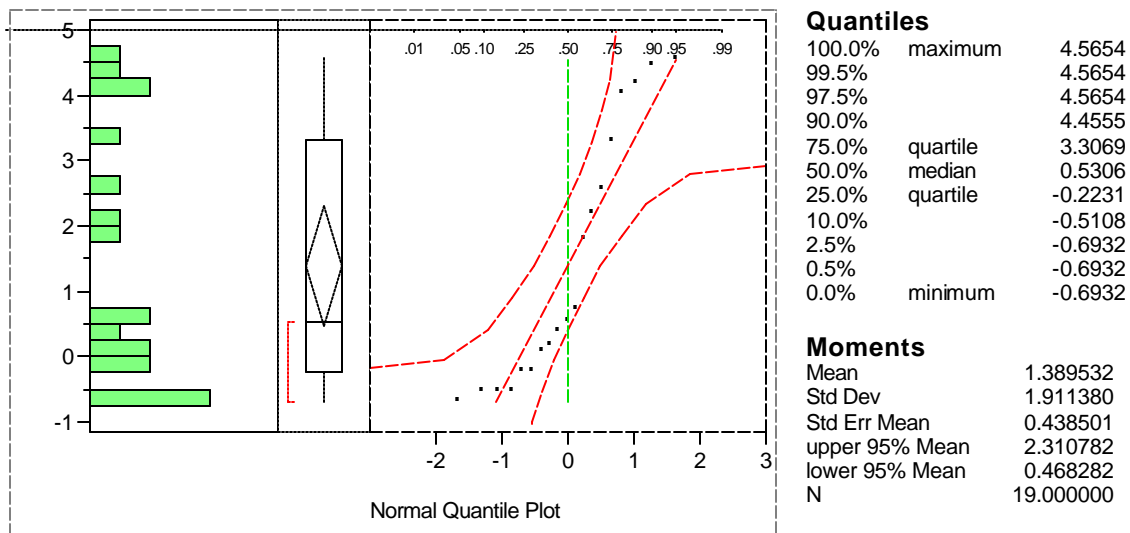
reported in figure 10 represent parameters of the lognormal distribution. However, they do not correspond to the unbiased estimators of the concentrations seen in stratum A.

Gilbert uses the following formulas for unbiased estimators of the mean ( $\hat{\mu}$ ) and variance ( $\hat{\sigma}^2$ ) of a two-parameter lognormal distribution:

$$\hat{m} = \exp\left(\bar{y} + \frac{s_y^2}{2}\right) \quad \text{Equation 1}$$

$$\hat{s}^2 = \hat{m}^2 [\exp(s_y^2) - 1] \quad \text{Equation 2}$$

While only half of the data fit approximate lognormal distributions, the lack of lognormal conformity among the other distributions suggests insufficient evidence (non detects in the data set). Figure 11 shows a typical distribution after natural log conversion with a smaller data set.



**Figure 11. Butyrate Converted Distribution from Strata C**

The data set contains only 19 detectable data points of the 66 in the strata. While the lack of data cannot sufficiently grant lognormalcy, statistical authors suggest that the

lognormal density model is the most commonly used for environmental data. The lognormal distribution is used to model many kinds of environmental contaminant data (Gilbert, 1987). Regardless of fit, all distributions were analyzed as such.

## **Findings**

Tables 7 and 8 show the estimated mean and variance of the concentrations among each analyte and population. The tables also demonstrate the two parameters (mean and variance) of the lognormal distribution. Notice the correlation between actual obtained data over each population from Appendices I thru AV to the variance of the distribution, suggesting the more evidence obtained the greater degree of confidence in concentration. Another point of interest in the tables is the difference in concentration among the strata or population. This could suggest that a parameter in the design of the wetland, volume of anaerobic region, is correlated to higher organic acid concentrations. As seen in layers C and B, notice the higher concentrations of organic acids (excluding Acetate) in layer B versus C. Assuming both are anaerobic, strata B sampling points have approximately 32,400 ft<sup>3</sup> of reductive matrix below them compared to 10,800 ft<sup>3</sup> below strata C sampling points.

**Table 7. Organic Concentrations and Distribution Parameters**

	Acetate (ppm)	Butyrate (ppb)	Formate (ppb)	Lactate (ppb)	Propionate (ppb)
<b>Strata A</b>					
Concentration $\mu\text{hat}$	2.796034792	100.5435441	205.6367873	52.31961403	56.17728714
Estimates $\sigma\text{hat}^2$	445.2349669	1368468.508	21069.7744	904.0876519	353918.3632
Distribution ybar	-1.001599777	2.152900448	5.123958369	3.814676836	1.664175551
Parameters $s_y$	2.014845922	2.217065836	0.63585073	0.534218109	2.174551439
<b>Strata B</b>					
Concentration $\mu\text{hat}$	0.773169943	227.823626	236.3230846	209.3630195	29.89345528
Estimates $\sigma\text{hat}^2$	4.252144813	62243038.03	8442.236634	9371.515529	37163.37907
Distribution ybar	-1.303995626	1.883448125	5.394813545	5.247191271	1.521859011
Parameters $s_y$	1.446885773	2.662751822	0.375196819	0.440178168	1.93689471
<b>Strata C</b>					
Concentration $\mu\text{hat}$	4.525782755	24.93366732	19.83254165	95.32467834	1.357419706
Estimates $\sigma\text{hat}^2$	142.1001267	23378.37553	1404.948167	10407.30047	1.469559578
Distribution ybar	0.473987277	1.389532109	2.227355838	4.17564403	0.012372809
Parameters $s_y$	1.43930766	1.911380068	1.232857063	0.873664354	0.765784321

Tables 7 and 8 display both the expected value of analyte ( $\mu\text{hat}$ ) and the variance of its distribution ( $\sigma\text{hat}^2$ ). Discrete values for each piezometer were fit to a continuous lognormal curve whose parameters are described by ybar and  $s_y$ . The parameters may assist modelers of such ecosystems and are displayed for that intent.

**Table 8. Inorganic Concentrations and Distribution Parameters**

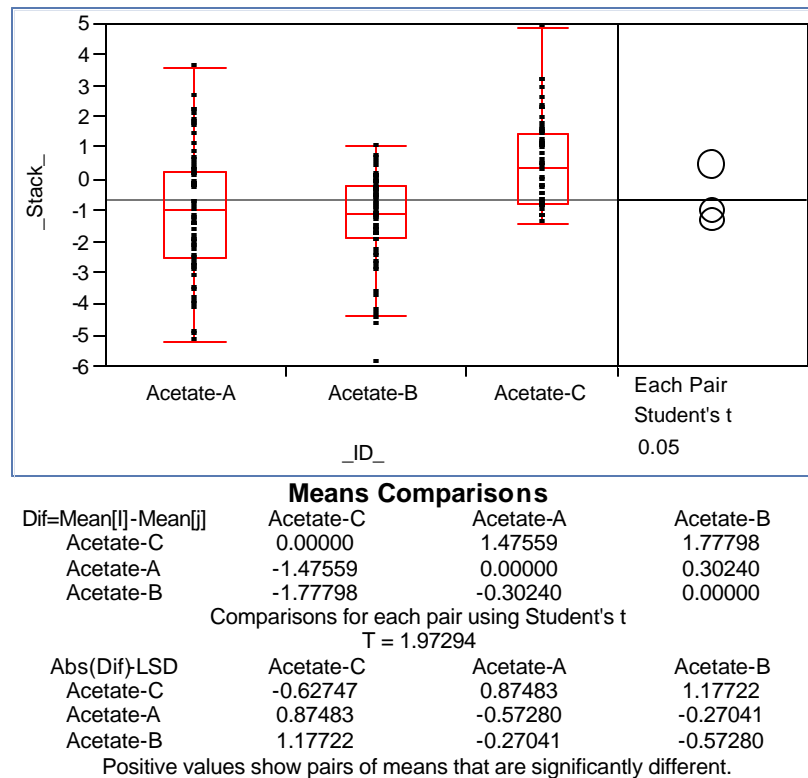
	Chloride (ppm)	Fluoride (ppb)	Nitrate (ppm)	Nitrite (ppb)	Sulfate (ppm)
<b>Strata A</b>					
Concentration $\mu\text{hat}$	82.53684529	167.0741787	15.62303822	2.594088953	15.90897829
Estimates $\sigma\text{hat}^2$	1083.374988	918.7604366	83.52204278	15.02358105	409.5922309
Distribution $y\text{bar}$	4.339452445	5.102245822	2.601594507	0.366597707	2.285615234
Parameters $s_y$	0.384167564	0.179955968	0.54249816	1.083178352	0.981089586
<b>Strata B</b>					
Concentration $\mu\text{hat}$	65.94869099	191.6173332	15.47692848	3.809280422	12.33440055
Estimates $\sigma\text{hat}^2$	216.0918291	724.2355581	27.26033034	32.85010869	118.5322089
Distribution $y\text{bar}$	4.164631933	5.245733986	2.685459364	0.745983951	2.224334773
Parameters $s_y$	0.220204892	0.139759373	0.328301893	1.087617906	0.759022237
<b>Strata C</b>					
Concentration $\mu\text{hat}$	80.95832513	156.2291712	3.592031433	6.138907166	50.0432626
Estimates $\sigma\text{hat}^2$	5.084901576	84.71705647	18.53877645	52.6647929	8.855947432
Distribution $y\text{bar}$	4.393546759	5.049591512	0.833372001	1.377442581	3.911122874
Parameters $s_y$	0.027848099	0.058863623	0.943764696	0.935098026	0.059413963

Contour plots were constructed using WINSURF 5.03 software. Appendices AX thru BG show the concentration levels for each population by analyte. At first observation the highly variable sampling points seem random among each stratum. However, the organic acid concentrations tend to have higher concentration spikes near the weir end of the wetland (piezometers 37 through 66). The soil conditions in this area during wetland preparation were significantly more compact in spot areas than the other half of the wetland. From conversations with construction inspectors, the contractor responsible for wetland construction staged equipment on this end of the wetland. The spotty compacted soil suggests a low hydraulic conductivity and longer retention time for microorganism cultures to produce the mono-carboxylic metabolites in those areas. The

inorganic spikes in concentrations seem extremely random. Consistently high chloride concentrations at piezometer 56A are an interesting phenomenon. This area had an extremely slow recovery rate per Appendix D.

## Population Comparison

Tables 7 and 8 show the different concentrations among the populations. However, in order to make inferences upon dynamics of each they must be shown to be statistically significant. A Student t test statistic is employed by JMP software to compare the means for each concentration. This can only be done to the transformed data sets as they assume a normal distribution stated previously in the distribution of data section. Figure 12 demonstrates the results of this test for acetate among all three populations.



**Figure 12. Acetate Population Comparison**

From the figure, acetate concentrations from C are statistically significant from B or A given a confidence level of 95%. However, A and B's difference is not significant. The data set does not give enough evidence to say with 95% confidence that concentrations from strata A are different from B. Tables 9 and 10 illustrate the comparison of means among all analytes.

**Table 9. Organic Analyte Mean Comparison of Populations**

	<b>Acetate (ppm)</b>	<b>Butyrate (ppb)</b>	<b>Formate (ppb)</b>	<b>Lactate (ppb)</b>	<b>Propionate (ppb)</b>
<b>Strata A</b>	2.796034792*	100.5435441*	205.6367873*	52.31961403*	56.17728714*
<b>Strata B</b>	0.773169943*	227.823626*	236.3230846**	209.3630195**	29.89345528*
<b>Strata C</b>	4.525782755**	24.93366732*	19.83254165***	95.32467834***	1.357419706**

**Table 10. Inorganic Analyte Mean Comparison of Populations**

	<b>Chloride (ppm)</b>	<b>Fluoride (ppb)</b>	<b>Nitrate (ppm)</b>	<b>Nitrite (ppb)</b>	<b>Sulfate (ppm)</b>
<b>Strata A</b>	82.53684529*	167.0741787*	15.62303822*	2.594088953*	15.90897829*
<b>Strata B</b>	65.94869099**	191.6173332**	15.47692848*	3.809280422**	12.33440055*
<b>Strata C</b>	80.95832513*	156.2291712***	3.592031433**	6.138907166***	50.0432626**

The number of asterisks in the table above signifies computed means from the same population. As shown in Figure 12, means computed in strata A and B are not statistically significant and therefore have the same number of asterisks in their respective cells. Whereas the acetate concentration in Strata C has a different number of asterisks to denote its significance from A and B.

Half of the analytes in Tables 9 and 10 show similar responses to acetate. Comparing the data in Appendices I thru AV to the above tables demonstrates that significance is positively correlated to the amount of evidence obtained. Wetland dynamics also play a role in distinguishing strata. Nitrate, for example, has significantly smaller concentrations in the bottom layer compared to that in A and B, suggesting the use of nitrate as an electron acceptor in metabolism of microorganism cultures.

## Trend Analysis

Using the estimated means of the data set in Tables 7 and 8, trends among analytes or populations can be seen without time dependence. For the purposes of this study, the month of January 2002 is a single time frame.

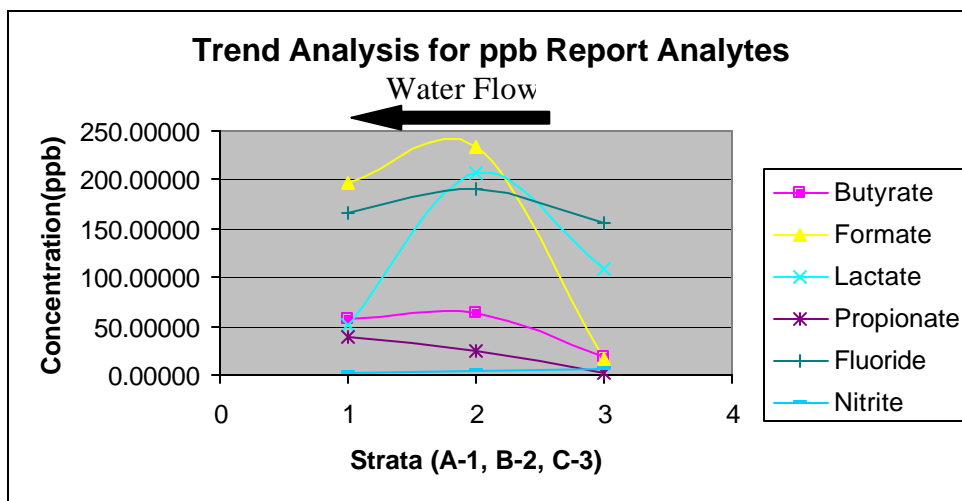


Figure 13. Trends in PPM Analyte Concentrations

Figure 13 shows a common characteristic among the mono-carboxylic acids of reaching maximum concentrations in strata B. The figure gives greater confidence in a previous inference that higher anaerobic volumes allow higher organic acid concentrations.

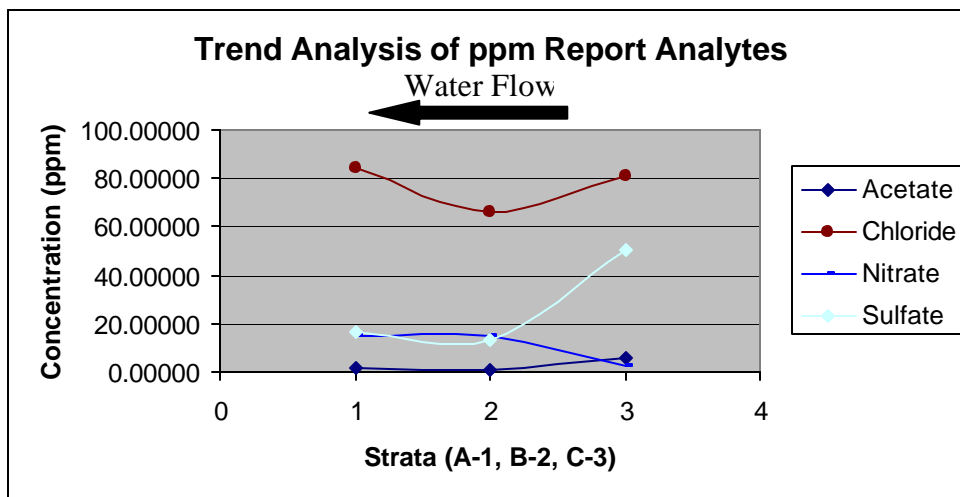


Figure 14. Trends in PPB Analyte Concentrations

Figure 14 demonstrates a suggested competition of electron acceptors. An inverse relationship between sulfate and nitrate occurs as water flows from C to A. While both serve as electron acceptors in the anaerobic regions of B and C, their apparent appeal to cultures differs by population. Literature suggests that nitrate would be the most desirable of the two resources (Seagren and Becker, 1999). However, sulfate concentrations are drastically reduced in the anaerobic profile versus an increase nitrate. This suggests a prevalent sulfate-reducing culture in the anaerobic strata of cell #1.



## **V. Discussion**

This study successfully characterized concentration levels of five organic and five inorganic analytes of a constructed wetland used for chlorinated ethene remediation. The intent of a sub-surface flow cell is to initially provide reductive, anaerobic conditions, which enhance remediation of the underlain chlorinated ethene plume. Using this design, higher levels of organic acids are expected in the anaerobic regions as a result of the fermentation of humic substances. While the concentrations varied over the three selected strata, low-molecular-mono-carboxylic acids were prevalent in those expected regions. On the same note, lower concentrations of electron acceptor inorganics were expected from strata C to A as a result of fermentation. Not only were results consistent with this hypothesis, but a negative correlation was also seen between nitrate and sulfate concentrations from populations C to B either to suggest competition for the two resources or prevalent microorganism cultures.

Increasing organic acid production and changes in inorganic electron acceptors in the assumed anaerobic regions (strata B and C) of the wetland gives confidence to the assumption that a reductive environment is present. The results demonstrate that manipulation in design and construction can effects the zones necessary for reduction and ultimately the wetland's remediation effectiveness. Correlation among data obtained in this study to the chlorinated ethene level project and other research will allow a designer to vary anaerobic volumes, flow rates, plant species, and soil type to possibly providing DNAPL plume containment and remediation.

## Sources of Variability and Bias

Variability and bias are found in all procedures from the sampling plan to sample analysis. Measurement error is correlated to the precision of the unbiased estimator of  $\mu$  (Gilbert, 1987). Variability in methodology can have compounding effects on concentration and give little confidence among thesis objectives. For example, allowing high chloride residue on re-usable sampling vials can lead to misleading chloride concentrations that assumed a higher efficiency than how the wetland actually operates. One such procedure is found in the methodology. A 1% solution of Liquinox and DI water was used to clean sampling vials. The 1% cleaning solution was analyzed to show a 1.17ppm average concentration of chloride and a 12.85ppm average concentration of sulfate. Any residue left after a DI water rinse could give higher than actual levels of each. While time constraints did not allow the error measurement in the research, Table 11 demonstrates possible sources of variability and observed degrees during this effort.

**Table 11. Possible Sources of Variability and Degree**

Variability Source	Degree
Piezometer Placement	Low
Wetland Dynamics	High
External Standards	Low
Background (field and instrument)	Low to Medium
Chromatogram Peak Integration	Low to Medium
Calibration	Low
Sample Extraction	Medium
Sample Preparation and Preservation	Low to Medium
Analysis	Low

Bias among results can be measured against expected mean values. Statistical bias is a discrepancy between the expected value of an estimator and the population parameter being estimated (Gilbert, 1987). Gilbert defines a mean estimator to equal the true mean multiplied by a bias factor. Assuming lognormal distribution and the following formula

for bias, tables 12 and 13 depict bias factors for each analyte by population. Bias factors greater than 1 tend higher imply that estimated means predominately have higher concentrations than actual and vise-versa.

$$E\left[\exp\left(ybar + \frac{s_y^2}{2}\right)\right] = m\left(1 - \frac{s_y^2}{n}\right)^{\frac{-(n-1)}{2}} \exp\left(-\frac{n-1}{2n}s_y^2\right) \quad \text{Equation 3}$$

$$= (truemean)(biasfactor)$$

**Table 12. Bias Factors for Organic Analytes**

	Acetate	Butyrate	Formate	Lactate	Propionate
<b>Strata A</b>	1.066223793	1.019841599	1.210876405	1.017140902	1.002226237
<b>Strata B</b>	1.016843878	1.341679511	1.000621805	1.000304762	1.124123924
<b>Strata C</b>	1.019841599	3.661606847	1.000075158	1.000140333	1.088607776

**Table 13. Bias Factors for Inorganic Analytes**

	Chloride	Fluoride	Nitrate	Nitrite	Sulfate
<b>Strata A</b>	1.00206763	1.000000002	1.000000045	1.003083879	1.002925993
<b>Strata B</b>	1.000081379	1.000003973	1.000344772	1.005458426	1.003496283
<b>Strata C</b>	1.000008776	1.000001445	1.000044043	1.005378652	1.001246208

On average the organics in table 4 are approximately 24% greater than actual wetland concentrations (based upon equation 3), while the inorganics show only a 0.16% difference between reported in table 5 and actual. Higher than normal readings is not uncommon among organic acids over short periods of time. MacGowan and Surdam (1994) witnessed an increase of 1.6% (on average) over a 24-hour period of an acetate standard solution.

Gilbert's statistical bias equation is more a function of sample size than variance. However, the purpose of tables 12 and 13 is to show more data needs to be taken,

variability might be due to methodology, and the assumption of a lognormal distribution for all thirty data sets may not be accurate.

## **Recommendations**

The single largest source of bias and variability could be the state of the wetland ecosystem. Due to the stresses of preparation and sampling and relatively young age, the constructed cell is believed to be in transition. Maintenance of parameters, such as flow rate, weir height and plant species will help determine whether the wetland is allogenic or autogenic in succession and hopefully allow a steady state in terms of its internal dynamics.

Follow-on work is encouraged in this area of study to answer questions on reported anomalies and wetland dynamics by comparing changes in design parameters. A comparison between Cell #1 and iron rich Cell #2 using current methodology may allow designers of such systems to increase reductive conditions by manipulation of strata location and soil type. Another comparison worth noting is the study of seasonality. This study was taken during the middle of winter with little or no plant species interaction and low nutrient cycling. As they increase in spring and summer months, the organic acid concentrations could show similar increases.

A study correlating existing data to other research is another area of interest. Chapter III discussed several projects that can be correlated to the reported data that could explain anomalies or provide evidence validating suggested inferences. Levels of pH, Dissolved Oxygen (DO), temperature, conductivity, Dissolved Organic Carbon (DOC), orthophosphates, and CO<sub>2</sub>, H<sub>2</sub> and CH<sub>4</sub> emissions could provide important ties to this study that may explain, with some degree of confidence, the interactions of a

constructed cell used for this purpose. Using the recommendations shown above, Chapelle and others (1995) provide a hierarchical model to determine the terminal electron-accepting processes. This model could be applied to each stratum to better explain processes and species prevalent.

A study of the changes in methodology to create greater confidence in outcome may help validate inferences suggested. The manufacturer recommends adding 10ppm of chromate as a preservative of organic acid samples. Another approach suggested to minimize plankton effects is to freeze samples upon extraction. An internal standard could also be added to samples to not only account for the matrix effects, but also to decrease variability in method procedure. Other methodology investigations could be the use of replicates versus separate sampling, filtering in the field versus in lab, peak integration windows using PeakNet 6.30, matrix effects due to stagnation between sampling and analysis, subtracting blank analysis runs from chromatograms, and adding varying amounts of methanol to reduce instrument background and lower baseline. Changing sample sizes could also give confidence in future research. An example might be to break up the assumed aerobic layer of strata A by its plots of plant species. Tests of significance could give a designer enough evidence to plant specific species in order to meet objectives. This option was considered for this research, however the species interaction was assumed to be too low to provide sufficient support.

## **Conclusion**

There is hope that constructed cells may replace traditional pump-and-treat systems. Their presence would reduce relative operational costs and provide form as well

as a multi-faceted function. Mono-carboxylic acids and the inorganics reported here may provide the verification needed to design wetlands to meet that objective.

While the study did show significant differences among analytes by sediment layer, it has room for substantial improvement in methodology and statistical analysis. The variance can be minimized and correlated with other areas of interest to propose changes in design and construction in order to maximize effectiveness that might someday lead to total plume containment and remediation.

### Appendix A: Plant Species Table

Subplot	Vegetation
1	<i>Carex Hystercina</i>
2	<i>Scirpus Atrovirens</i>
3	<i>Eleocharis Erythropodo</i>
4	<i>Carex Comosa</i>
5	<i>Acorus Calamus</i>
6	<i>Scirpus Atrovirens</i>
7	<i>Eleocharis acicularis; Carex Cristatella</i>
8	<i>Juncus Effusus; Scirpus Validus</i>
9	<i>Carex Vulpinoidea</i>
10	<i>Juncus Torreyi; Juncus Dudleyi; Carex Lupiformis</i>
11	Mix
12	Blank
13	<i>Carex Hystercina; Mimulus Ringens; Penthorum Sedoides;</i> <i>Ascepias Incarnata</i>
14	<i>Carex Cristatella; Carex Vulpinoidea; Penthorum Sedoides;</i> <i>Mimulus Ringens; Asclepias Incarnata</i>

## Appendix B: Sampling Procedure

1. Purge piezometers throughout one stratum with assembly (cut to correct length and end frayed—to pass by the ½” Teflon tubing/piezometer lip).
2. NOTE: Average elapsed time for purging each strata:  
    A—1 ½ hours  
    B—2 hours  
    C—2 ½ hours
3. Draw 20 mL in syringe, using the assembly.
4. Turn valve on cockstop to open the un-occupied fitting while closing the tubing valve.
5. Purge the 20mL in the syringe.
6. Turn valve on cockstop to open the tubing valve while closing the un-occupied fitting at the same time.
7. Draw 50mL of piezometer sample in the syringe.
8. Turn valve on cockstop to open the un-occupied fitting while closing the tubing valve.
9. Purge 40mL of sample into a 40mL vial.
10. Cap the vial.
11. Release jumbo syringe from cockstop and tubing assembly.
12. Pull cockstop and tubing assembly from piezometer, then insert into DI water reservoir.
13. Attach jumbo syringe to assembly and begin drawing, at a minimum, 50mL of DI water into the syringe.
14. Turn valve on cockstop to open the un-occupied fitting while closing the tubing valve.
15. Release jumbo syringe from cockstop and gently shake syringe with DI water to keep all suspended particles in the DI solution.
16. Purge contents of syringe then re-attach to assembly.
17. Turn valve on cockstop to open the tubing valve while closing the un-occupied fitting at the same time.
18. Draw 20mL into the jumbo syringe.
19. Pull the attached syringe and assembly from DI water, while grasping the cockstop and tubing assembly at the cockstop,
20. Purge the remaining DI water in the system out of the Teflon tubing, while holding at the cockstop.
21. Draw the DI water remaining in the system back into the syringe.
22. Release the jumbo syringe from the assembly and purge the remaining DI water to completely flush the sampling assembly and syringe.
23. Repeat steps 2 thru 22 to sample next piezometer.
24. Repeat sampling each point for entire strata.



### **Appendix C: Sample Preparation Procedure**

1. Pull only 2 mL of a wetland sample (in the 40 mL vial) into a 5 mL glass syringe.
2. Discard the 2mL of wetland sample in appropriate reservoir.
3. Fill the entire 5 mL glass syringe from same wetland sample.
4. Attach 0.45  $\mu$ L syringe filter onto 5mL glass syringe.
5. Gently push the 5 mL sample from syringe through filter and into a 10 mL capacity autosampler vial.
6. Mark with corresponding number from wetland sampling point.
7. Flush 5 mL glass syringe three times with DI water.
8. Discard remaining wetland sample from 40 mL vial into the appropriate reservoir.
9. Repeat steps 1 thru 8 for remaining samples.
10. Load filtered and marked autosampler vials into autosampler tray.
11. Set up sequence using the PeakNet 6.0 software to mirror placement in tray.

## Appendix D: Recovery Log for Top Strata

Recovery Tests (Strata A)										
Plant Species	Top Strata	First Purge	Second Purge	Elapsed Time (1 - 2)	Volume (mL)	Recovery Rate (mL/hr)	Third Purge	Elapsed Time (2-3)	Volume (mL)	Recovery Rate (mL/hr)
<b>Plot 1</b>										
--Carex Hystercina	1	11/3/01 1:50 PM	11/3/01 4:11 PM	2:21	25	10.64	11/4/01 9:19 AM	17:08	100	5.84
	2	11/3/01 1:55 PM	11/3/01 4:12 PM	2:17	2	0.88	11/4/01 9:21 AM	17:09	19	1.11**
	3	11/3/01 1:58 PM	11/3/01 4:14 PM	2:16	1	0.44	11/4/01 9:22 AM	17:08	25	1.46**
	7	11/3/01 2:23 PM	11/3/01 4:26 PM	2:03	63	30.73	11/4/01 9:39 AM	17:13	108	6.27
	8	11/3/01 2:20 PM	11/3/01 4:24 PM	2:04	11	5.32	11/4/01 9:38 AM	17:14	131	7.60
	9	11/3/01 2:17 PM	11/3/01 4:23 PM	2:06	14	6.67	11/4/01 9:36 AM	17:13	68	3.95
<b>Plot 2</b>										
--Scirpus Atrovirens	4	11/3/01 2:01 PM	11/3/01 4:15 PM	2:14	13	5.82	11/4/01 9:24 AM	17:09	67	3.91
	5	11/3/01 2:04 PM	11/3/01 4:16 PM	2:12	22	10.00	11/4/01 9:26 AM	17:10	96	5.59
	6	11/3/01 2:06 PM	11/3/01 4:17 PM	2:11	5	2.29	11/4/01 9:28 AM	17:11	24	1.40**
	10	11/3/01 2:15 PM	11/3/01 4:22 PM	2:07	123	58.11	11/4/01 9:35 AM	17:13	127	7.38
	11	11/3/01 2:12 PM	11/3/01 4:20 PM	2:08	5.5	2.58	11/4/01 9:33 AM	17:13	21	1.22**
	12	11/3/01 2:10 PM	11/3/01 4:19 PM	2:09	6	2.79	11/4/01 9:33 AM	17:14	28	1.62**
<b>Plot 3</b>										
--Eleocharis Erythropoda	13	11/3/01 2:25 PM	11/3/01 4:27 PM	2:02	14	6.89	11/4/01 9:40 AM	17:13	76	4.41
	14	11/3/01 2:28 PM	11/3/01 4:28 PM	2:00	10	5.00	11/4/01 9:41 AM	17:13	58	3.37
	15	11/3/01 2:30 PM	11/3/01 4:29 PM	1:59	51	25.71	11/4/01 9:42 AM	17:13	139	8.07
	19	11/3/01 2:57 PM	11/3/01 4:43 PM	1:46	79	44.72	11/4/01 9:55 AM	17:12	132	7.67
	20	11/3/01 2:58 PM	11/3/01 4:41 PM	1:43	2	1.17	11/4/01 9:53 AM	17:12	9	0.52**
	21	11/3/01 3:00 PM	11/3/01 4:40 PM	1:40	8.5	5.10	11/4/01 9:52 AM	17:12	22	1.28**
<b>Plot 4</b>										
--Carex Comosa	16	11/3/01 2:46 PM	11/3/01 4:30 PM	1:44	10	5.77	11/4/01 9:44 AM	17:14	127	7.37
	17	11/3/01 2:48 PM	11/3/01 4:31 PM	1:43	29	16.89	11/4/01 9:45 AM	17:14	65	3.77
	18	11/3/01 2:50 PM	11/3/01 4:31 PM	1:41	3	1.78	11/4/01 9:46 AM	17:15	20	1.16**
	22	11/3/01 3:02 PM	11/3/01 4:39 PM	1:37	100	61.86	11/4/01 9:50 AM	17:11	145	8.44
	23	11/3/01 3:03 PM	11/3/01 4:35 PM	1:32	48	31.30	11/4/01 9:49 AM	17:14	145	8.41
	24	11/3/01 3:05 PM	11/3/01 4:34 PM	1:29	36	24.27	11/4/01 9:56 AM	17:22	141	8.12
<b>Plot 5</b>										
--Aeorus Calamus	25	11/3/01 3:16 PM	11/3/01 4:45 PM	1:29	57	38.43	11/4/01 9:56 AM	17:11	63	3.67
	26	11/3/01 3:14 PM	11/3/01 4:46 PM	1:32	0	0.00	11/4/01 9:56 AM	17:10	2	0.12**
	27	11/3/01 3:13 PM	11/3/01 4:46 PM	1:33	0	0.00	11/4/01 9:57 AM	17:11	2	0.12**
	31	11/3/01 3:20 PM	11/3/01 5:01 PM	1:41	55	32.67	11/4/01 10:05 AM	17:04	142	8.32
	32	11/3/01 3:21 PM	11/3/01 4:59 PM	1:38	13	7.96	11/4/01 10:04 AM	17:05	85	4.98
	33	11/3/01 3:22 PM	11/3/01 4:58 PM	1:36	12	7.50	11/4/01 10:03 AM	17:05	64	3.75
<b>Plot 6</b>										
--Scirpus Atrovirens	28	11/3/01 3:12 PM	11/3/01 4:47 PM	1:35	9	5.68	11/4/01 9:58 AM	17:11	45	2.62**
	29	11/3/01 3:11 PM	11/3/01 4:50 PM	1:39	145	87.88	11/4/01 10:07 AM	17:17	145	8.39
	30	11/3/01 3:07 PM	11/3/01 4:52 PM	1:45	145	82.86	11/4/01 10:06 AM	17:14	145	8.41
<b>Plot 7</b>										
--Eleocharus Acicularis --Carex Cristatella	37	11/3/01 3:33 PM	11/3/01 5:02 PM	1:29	14	9.44	11/4/01 10:10 AM	17:08	113	6.60
	38	11/3/01 3:32 PM	11/3/01 5:03 PM	1:31	5	3.30	11/4/01 10:11 AM	17:08	30	1.75**
	39	11/3/01 3:31 PM	11/3/01 5:04 PM	1:33	0	0.00	11/4/01 10:12 AM	17:08	9	0.53**

\*\* indicates possible candidate for well development efforts

Bold numbers indicate that well was completely recovered in elapsed time. No numbers higher than 145mL (total volume of well and tube)

Recovery Tests (Strata A)										
				Recovery				Recovery		
Plant Species	Top Strata Plot #	First Purge	Second Purge	Elapsed Time (1 - 2)	Volume (mL)	Rate (mL/hr)	Third Purge	Elapsed Time (2-3)	Volume (mL)	Rate (mL/hr)
--Juncus	34	11/3/01 3:23 PM	11/3/01 4:58 PM	1:35	28	17.68	11/4/01 10:02 AM	17:04	145	8.50
--Effusus	35	11/3/01 3:25 PM	11/3/01 4:56 PM	1:31	62	40.88	11/4/01 10:09 AM	17:13	124	7.20
--Scirpus Validus	36	11/3/01 3:26 PM	11/3/01 4:55 PM	1:29	145	97.75	11/4/01 10:10 AM	17:15	145	8.41
	40	11/3/01 3:30 PM	11/3/01 5:05 PM	1:35	22	13.89	11/4/01 10:14 AM	17:09	116	6.76
	41	11/3/01 3:28 PM	11/3/01 5:05 PM	1:37	3	1.86	11/4/01 10:14 AM	17:09	12	0.70**
	42	11/3/01 3:27 PM	11/3/01 5:07 PM	1:40	124	74.40	11/4/01 10:15 AM	17:08	145	8.46
Plot 9										
--Carex Valpinoidea	43	11/3/01 3:35 PM	11/3/01 5:13 PM	1:38	1	0.61	11/4/01 10:18 AM	17:05	8	0.47**
--(Mix)	44	11/3/01 3:36 PM	11/3/01 5:12 PM	1:36	1	0.63	11/4/01 10:17 AM	17:05	4	0.23**
	45	11/3/01 3:37 PM	11/3/01 5:11 PM	1:34	5	3.19	11/4/01 10:17 AM	17:06	39	2.28**
Plot 10										
--Juncus Torreyi	46	11/3/01 3:40 PM	11/3/01 5:11 PM	1:31	9	5.93	11/4/01 10:16 AM	17:05	57	3.34
--Juncus Dudleyi	47	11/3/01 3:42 PM	11/3/01 5:10 PM	1:28	4	2.73	11/4/01 10:15 AM	17:05	19	1.11**
--Carex Lupiformis	48	11/3/01 3:42 PM	11/3/01 5:09 PM	1:27	30	20.69	11/4/01 10:14 AM	17:05	57	3.34
Plot 11										
--(Mix)	49	11/3/01 3:51 PM	11/3/01 5:14 PM	1:23	3	2.17	11/4/01 10:19 AM	17:05	27	1.58**
	50	11/3/01 3:49 PM	11/3/01 5:17 PM	1:28	145	98.86	11/4/01 10:21 AM	17:04	145	8.50
	51	11/3/01 3:48 PM	11/3/01 5:18 PM	1:30	4	2.67	11/4/01 10:22 AM	17:04	16	0.94**
Plot 12										
--(Blank)	52	11/3/01 3:46 PM	11/3/01 5:19 PM	1:33	3	1.94	11/4/01 10:22 AM	17:03	25	1.47**
	53	11/3/01 3:45 PM	11/3/01 5:21 PM	1:36	136	85.00	11/4/01 10:23 AM	17:02	118	6.93
	54	11/3/01 3:44 PM	11/3/01 5:22 PM	1:38	62	37.96	11/4/01 10:25 AM	17:03	144	8.45
	58	11/3/01 3:59 PM	11/3/01 5:26 PM	1:27	20	13.79	11/4/01 10:28 AM	17:02	120	7.05
	59	11/3/01 4:01 PM	11/3/01 5:25 PM	1:24	6	4.29	11/4/01 10:27 AM	17:02	27	1.59**
	60	11/3/01 4:02 PM	11/3/01 5:24 PM	1:22	33	24.15	11/4/01 10:26 AM	17:02	129	7.57
Plot 13										
--Carex Hystercina	55	11/3/01 3:52 PM	11/3/01 5:28 PM	1:36	70	43.75	11/4/01 10:31 AM	17:03	134	7.86
--Mimulus Ringens	56	11/3/01 3:54 PM	11/3/01 5:27 PM	1:33	0	0.00	11/4/01 10:29 AM	17:02	0	0.00**
--Penthorum Sedoides	57	11/3/01 3:56 PM	11/3/01 5:26 PM	1:30	4	2.67	11/4/01 10:29 AM	17:03	17	1.00**
--Asclepias Incarnata	61	11/3/01 4:09 PM	11/3/01 5:29 PM	1:20	8	6.00	11/4/01 10:31 AM	17:02	18	1.06**
	62	11/3/01 4:08 PM	11/3/01 5:30 PM	1:22	0	0.00	11/4/01 10:31 AM	17:01	0	0.00**
	63	11/3/01 4:07 PM	11/3/01 5:31 PM	1:24	9	6.43	11/4/01 10:32 AM	17:01	52	3.06
Plot 14										
--Carex Cristatella	64	11/3/01 4:06 PM	11/3/01 5:32 PM	1:26	8	5.58	11/4/01 10:33 AM	17:01	56	3.29
--Carex Valpinoidea	65	11/3/01 4:05 PM	11/3/01 5:34 PM	1:29	145	97.75	11/4/01 10:35 AM	17:01	145	8.52
--Penthorum Sedoides	66	11/3/01 4:03 PM	11/3/01 5:36 PM	1:33	145	93.55	11/4/01 10:37 AM	17:01	145	8.52
--Mimulus Ringens										
--Asclepias Incarnata										

\*\* indicates possible candidate for well development efforts

Bold numbers indicate that well was completely recovered in elapsed time. No numbers higher than 145mL (total volume of well and tube)

# Recovery Tests after Development (Strata A)

Plant Species	Top Strata	First Purge	Second Purge	Elapsed Time (1 - 2)	Volume (mL)	Recovery Rate (mL/hr)	Third Purge	Fourth Purge	Elapsed Time (3-4)	Volume (mL)	Recovery Rate (mL/hr)
<b>Plot 1</b>											
--Carex Hystercina	1										
	2	11/8/01 1:09 PM	11/9/01 4:24 PM	27:15:00	193	7.08	11/11/01 9:32 AM	11/11/01 10:32 AM	1:00:00	130	130.00
	3	11/8/01 1:07 PM	11/9/01 4:21 PM	27:14:00	144	5.29	11/11/01 9:33 AM	11/11/01 10:34 AM	1:01:00	201	197.70
	7										
	8										
	9										
<b>Plot 2</b>											
--Scirpus Atrovirens	4										
	5										
	6	11/8/01 1:00 PM	11/9/01 4:18 PM	27:18:00	127	4.65	11/11/01 9:35 AM	11/11/01 10:36 AM	1:01:00	123	120.98
	10										
	11	11/8/01 12:55 PM	11/9/01 4:12 PM	27:17:00	125	4.58	11/11/01 9:43 AM	11/11/01 10:38 AM	0:55:00	120	130.91
	12	11/8/01 12:48 PM	11/9/01 4:10 PM	27:22:00	154	5.63	11/11/01 9:38 AM	11/11/01 10:41 AM	1:03:00	117	111.43
<b>Plot 3</b>											
--Eleocharis Erythropoda	13										
	14										
	15										
	19										
	20	11/8/01 12:35 PM	11/9/01 3:57 PM	27:22:00	400	14.62	11/11/01 9:49 AM	11/11/01 10:44 AM	0:55:00	300	327.27
	21	11/8/01 12:31 PM	11/9/01 4:00 PM	27:29:00	231	8.41	11/11/01 9:50 AM	11/11/01 10:46 AM	0:56:00	156	167.14
<b>Plot 4</b>											
--Carex Comosa	16										
	17										
	18	11/8/01 12:40 PM	11/9/01 4:06 PM	27:26:00	136	4.96	11/11/01 9:46 AM	11/11/01 10:43 AM	0:57:00	124	130.53
	22										
	23										
	24										
<b>Plot 5</b>											
--Aeorus Calamus	25										
	26	11/8/01 12:40 PM	11/9/01 3:53 PM	27:13:00	123	4.52	11/11/01 9:52 AM	11/11/01 10:48 AM	0:56:00	122	130.71
	27	11/8/01 12:20 PM	11/9/01 3:51 PM	27:31:00	133	4.83	11/11/01 9:55 AM	11/11/01 10:49 AM	0:54:00	90	100.00
	31										
	32										
	33										
<b>Plot 6</b>											
--Scirpus Atrovirens	28	11/8/01 1:30 PM	11/9/01 3:40 PM	26:10:00	156	5.96	11/11/01 9:56 AM	11/11/01 10:52 AM	0:56:00	113	121.07
	29										
	30										
<b>Plot 7</b>											
--Eleocharus Acicularis	37										
--Carex Cristatella	38	11/8/01 12:12 PM	11/9/01 3:58 PM	27:46:00	149	5.37	11/11/01 9:58 AM	11/11/01 10:54 AM	0:56:00	123	131.79
	39	11/8/01 11:10 AM	11/9/01 3:32 PM	28:22:00	135	4.76	11/11/01 9:59 AM	11/11/01 10:56 AM	0:57:00	105	110.53

\*\* indicates possible candidate for well development efforts

Bold numbers indicate that well was completely recovered in elapsed time. No numbers higher than 145mL (total volume of well and tube)

**Recovery Tests after Development (Strata A)**

Plant Species	Top Strata	First Purge	Second Purge	Elapsed Time (1 - 2)	Volume (mL)	Recovery Rate (mL/hr)	Third Purge	Fourth Purge	Elapsed Time (3-4)	Volume (mL)	Recovery Rate (mL/hr)
<b>Plot 8</b>											
--Juncus	34										
--Effusus	35										
--Scirpus Validus	36										
	40										
	41	11/8/01 11:02 AM	11/9/01 3:29 PM	28:27:00	174	6.12	11/11/01 10:01 AM	11/11/01 10:58 AM	0:57:00	136	143.16
	42										
<b>Plot 9</b>											
--Carex Valpinoidea	43	11/8/01 11:02 AM	11/9/01 3:24 PM	28:22:00	134	4.72	11/11/01 10:02 AM	11/11/01 10:59 AM	0:57:00	100	105.26
--(Mix)	44	11/8/01 10:41 AM	11/9/01 3:22 PM	28:41:00	136	4.74	11/11/01 10:04 AM	11/11/01 11:00 AM	0:56:00	63	67.50
	45	11/8/01 11:05 AM	11/9/01 3:16 PM	28:11:00	257	9.12	11/11/01 10:07 AM	11/11/01 11:05 AM	0:58:00	204	211.03
<b>Plot 10</b>											
--Juncus Torreyi	46										
--Juncus Dudleyi	47	11/8/01 10:48 AM	11/9/01 3:12 PM	28:24:00	123	4.33	11/11/01 10:10 AM	11/11/01 11:06 AM	0:56:00	78	83.57
--Carex Lupiformis	48										
<b>Plot 11</b>											
--(Mix)	49	11/8/01 10:15 AM	11/9/01 3:04 PM	28:49:00	110	3.82	11/11/01 10:13 AM	11/11/01 11:10 AM	0:57:00	97	102.11
	50										
	51	11/8/01 10:11 AM	11/9/01 2:59 PM	28:48:00	125	4.34	11/11/01 10:15 AM	11/11/01 11:13 AM	0:58:00	112	115.86
<b>Plot 12</b>											
--(Blank)	52	11/8/01 10:09 AM	11/9/01 2:49 PM	28:40:00	187	6.52	11/11/01 10:18 AM	11/11/01 11:15 AM	0:57:00	157	165.26
	53										
	54										
	58										
	59	11/8/01 9:18 AM	11/9/01 2:29 PM	29:11:00	133	4.56	11/11/01 10:21 AM	11/11/01 11:21 AM	1:00:00	98	98.00
	60										
<b>Plot 13</b>											
--Carex Hystercina	55										
--Mimulus Ringens	56	11/8/01 9:44 AM	11/9/01 2:20 PM	28:36:00	146	5.10	11/11/01 10:21 AM	11/11/01 11:21 AM	1:00:00	134	134.00
--Penthorum Sedoides	57	11/8/01 9:49 AM	11/9/01 2:24 PM	28:35:00	90	3.15	11/11/01 10:24 PM	11/11/01 11:27 PM	1:03:00	415	395.24
--Asclepias Incarnata	61	11/8/01 9:05 AM	11/9/01 2:09 PM	29:04:00	126	4.33	11/11/01 10:28 AM	11/11/01 11:31 AM	1:03:00	36	34.29
	62	11/8/01 9:12 AM	11/9/01 2:06 PM	28:54:00	126	4.36	11/11/01 10:29 AM	11/11/01 11:32 AM	1:03:00	78	74.29
	63										
<b>Plot 14</b>											
--Carex Cristatella	64										
--Carex Valpinoidea	65										
--Penthorum Sedoides	66										
--Mimulus Ringens											
--Asclepias Incarnata											

## Appendix E: Recovery Log for Middle Strata

Recovery Tests (Strata B)										
	Middle Strata Plot	First Purge	Second Purge	Elapsed Time (1 - 2)	Volume (mL)	Recovery Rate (mL/hr)	Third Purge	Elapsed Time (2-3)	Volume (mL)	Recovery Rate (mL/hr)
Plant Species										
--Carex Hystercina	Plot 1	1 11/4/01 10:59 AM	11/4/01 1:00 PM	2:01	225	111.57	11/5/01 9:49 AM	20:49	185	8.89
		2 11/4/01 11:02 AM	11/4/01 1:01 PM	1:59	16	8.07	11/5/01 9:58 AM	20:57	86	4.11
		3 11/4/01 11:07 AM	11/4/01 1:03 PM	1:56	137	70.86	11/5/01 10:00 AM	20:57	196	9.36
		7 11/4/01 11:22 AM	11/4/01 1:17 PM	1:55	159	82.96	11/5/01 10:20 AM	21:03	153	7.27
		8 11/4/01 11:21 AM	11/4/01 1:15 PM	1:54	163	85.79	11/5/01 10:18 AM	21:03	157	7.46
		9 11/4/01 11:19 AM	11/4/01 1:13 PM	1:54	15	7.89	11/5/01 10:17 AM	21:04	67	3.18
	Plot 2									
		4 11/4/01 11:09 AM	11/4/01 1:05 PM	1:56	128	66.21	11/5/01 10:03 AM	20:58	162	7.73
		5 11/4/01 11:10 AM	11/4/01 1:07 PM	1:57	26	13.33	11/5/01 10:10 AM	21:03	125	5.94
--Scirpus Atrovirens		6 11/4/01 11:12 AM	11/4/01 1:08 PM	1:56	43	22.24	11/5/01 10:12 AM	21:04	147	6.98
		10 11/4/01 11:17 AM	11/4/01 1:12 PM	1:55	154	80.35	11/5/01 10:16 AM	21:04	165	7.83
		11 11/4/01 11:15 AM	11/4/01 1:10 PM	1:55	1	0.52	11/5/01 10:14 AM	21:04	17	0.81
		12 11/4/01 11:14 AM	11/4/01 1:09 PM	1:55	20	10.43	11/5/01 10:14 AM	21:05	128	6.07
	Plot 3									
--Eleocharis Erythropoda	13	11/4/01 11:24 AM	11/4/01 1:19 PM	1:55	68	35.48	11/5/01 10:21 AM	21:02	154	7.32
	14	11/4/01 11:25 AM	11/4/01 1:20 PM	1:55	45	23.48	11/5/01 10:23 AM	21:03	153	7.27
	15	11/4/01 11:27 AM	11/4/01 1:21 PM	1:54	66	34.74	11/5/01 10:24 AM	21:03	152	7.22
	19	11/4/01 11:42 AM	11/4/01 1:28 PM	1:46	103	58.30	11/5/01 10:38 AM	21:10	147	6.94
	20	11/4/01 11:40 AM	11/4/01 1:37 PM	1:57	77	39.49	11/5/01 10:36 AM	20:59	139	6.62
	21	11/4/01 11:38 AM	11/4/01 1:31 PM	1:53	191	101.42	11/5/01 10:34 AM	21:03	181	8.60
Plot 4										
--Carex Comosa	16	11/4/01 11:28 AM	11/4/01 1:22 PM	1:54	38	20.00	11/5/01 10:25 AM	21:03	140	6.65
	17	11/4/01 11:30 AM	11/4/01 1:24 PM	1:54	192	101.05	11/5/01 10:27 AM	21:03	187	8.88
	18	11/4/01 11:31 AM	11/4/01 1:25 PM	1:54	64	33.68	11/5/01 10:28 AM	21:03	140	6.65
	22	11/4/01 11:37 AM	11/4/01 1:29 PM	1:52	184	98.57	11/5/01 10:33 AM	21:04	170	8.07
	23	11/4/01 11:35 AM	11/4/01 1:27 PM	1:52	23	12.32	11/5/01 10:31 AM	21:04	133	6.31
	24	11/4/01 11:33 AM	11/4/01 1:26 PM	1:53	14	7.43	11/5/01 10:30 AM	21:04	73	3.47
Plot 5										
--Aeorus Calamus	25	11/4/01 11:43 AM	11/4/01 1:40 PM	1:57	114	58.46	11/5/01 10:39 AM	20:59	160	7.63
	26	11/4/01 11:44 AM	11/4/01 1:41 PM	1:57	101	51.79	11/5/01 10:41 AM	21:00	149	7.10
	27	11/4/01 11:46 AM	11/4/01 1:43 PM	1:57	4	2.05	11/5/01 10:42 AM	20:59	18	0.86
	31	11/4/01 12:06 PM	11/4/01 1:55 PM	1:49	141	77.61	11/5/01 10:57 AM	21:02	182	8.65
	32	11/4/01 12:04 PM	11/4/01 1:52 PM	1:48	113	62.78	11/5/01 10:56 AM	21:04	203	9.64
	33	11/4/01 12:03 PM	11/4/01 1:51 PM	1:48	225	125.00	11/5/01 10:54 AM	21:03	240	11.40
Plot 6										
--Scirpus Atrovirens	28	11/4/01 11:48 AM	11/4/01 1:43 PM	1:55	225	117.39	11/5/01 10:44 AM	21:01	225	10.71
	29	11/4/01 11:50 AM	11/4/01 1:45 PM	1:55	195	101.74	11/5/01 10:46 AM	21:01	188	8.95
	30	11/4/01 11:52 AM	11/4/01 1:46 PM	1:54	48	25.26	11/5/01 10:48 AM	21:02	162	7.70
Plot 7										
--Eleocharus Acicularis	37	11/4/01 12:08 PM	11/4/01 1:58 PM	1:50	34	18.55	11/5/01 10:59 AM	21:01	149	7.09
--Carex Cristatella	38	11/4/01 12:11 PM	11/4/01 2:00 PM	1:49	225	123.85	11/5/01 11:00 AM	21:00	225	10.71
	39	11/4/01 12:13 PM	11/4/01 2:03 PM	1:50	225	122.73	11/5/01 11:03 AM	21:00	225	10.71

\*\* indicates possible candidate for well development efforts

Bold numbers indicate that well was completely recovered in elapsed time. No numbers higher than 225mL (total volume of well and tube)

Recovery Tests (Strata B)										
Plant Species	Middle Strata Plot 8	First Purge	Second Purge	Elapsed Time (1 - 2)	Volume (mL)	Recovery Rate (mL/hr)	Third Purge	Elapsed Time (2-3)	Volume (mL)	Recovery Rate (mL/hr)
--Effusus	35	11/4/01 11:59 AM	11/4/01 1:48 PM	1:49	225	123.85	11/5/01 10:52 AM	21:04	225	10.68
--Scirpus Validus	36	11/4/01 11:54 AM	11/4/01 1:48 PM	1:54	225	118.42	11/5/01 10:51 AM	21:03	225	10.69
	40	11/4/01 12:14 PM	11/4/01 2:04 PM	1:50	37	20.18	11/5/01 11:05 AM	21:01	131	6.23
	41	11/4/01 12:16 PM	11/4/01 2:05 PM	1:49	20	11.01	11/5/01 11:06 AM	21:01	112	5.33
	42	11/4/01 12:17 PM	11/4/01 2:06 PM	1:49	22	12.11	11/5/01 11:07 AM	21:01	135	6.42
Plot 9										
--Carex Valpinoidea	43	11/4/01 12:26 PM	11/4/01 2:13 PM	1:47	10	5.61	11/5/01 11:13 AM	21:00	66	3.14
--(Mix)	44	11/4/01 12:24 PM	11/4/01 2:12 PM	1:48	5	2.78	11/5/01 11:12 AM	21:00	18	0.86
	45	11/4/01 12:22 PM	11/4/01 2:11 PM	1:49	94	51.74	11/5/01 11:11 AM	21:00	145	6.90
Plot 10										
--Juncus Torreyi	46	11/4/01 12:21 PM	11/4/01 2:09 PM	1:48	13	7.22	11/5/01 11:10 AM	21:01	98	4.66
--Juncus Dudleyi	47	11/4/01 12:20 PM	11/4/01 2:08 PM	1:48	12	6.67	11/5/01 11:09 AM	21:01	36	1.71
--Carex Lupiformis	48	11/4/01 12:19 PM	11/4/01 2:07 PM	1:48	5	2.78	11/5/01 11:08 AM	21:01	19	0.90
Plot 11										
--(Mix)	49	11/4/01 12:28 PM	11/4/01 2:14 PM	1:46	59	33.40	11/5/01 11:14 AM	21:00	117	5.57
	50	11/4/01 12:29 PM	11/4/01 2:15 PM	1:46	2	1.13	11/5/01 11:15 AM	21:00	3	0.14
	51	11/4/01 12:30 PM	11/4/01 2:16 PM	1:46	47	26.60	11/5/01 11:16 AM	21:00	137	6.52
Plot 12										
--(Blank)	52	11/4/01 12:32 PM	11/4/01 2:17 PM	1:45	2	1.14	11/5/01 11:17 AM	21:00	15	0.71
	53	11/4/01 12:33 PM	11/4/01 2:21 PM	1:48	163	90.56	11/5/01 11:18 AM	20:57	150	7.16
	54	11/4/01 12:35 PM	11/4/01 2:22 PM	1:47	13	7.29	11/5/01 11:19 AM	20:57	61	2.91
	58	11/4/01 12:40 PM	11/4/01 2:25 PM	1:45	139	79.43	11/5/01 11:23 AM	20:58	146	6.96
	59	11/4/01 12:39 PM	11/4/01 2:24 PM	1:45	2	1.14	11/5/01 11:22 AM	20:58	28	1.34
	60	11/4/01 12:38 PM	11/4/01 2:24 PM	1:46	4	2.26	11/5/01 11:21 AM	20:57	172	8.21
Plot 13										
--Carex Hystercina	55	11/4/01 12:44 PM	11/4/01 2:28 PM	1:44	4	2.31	11/5/01 11:27 AM	20:59	32	1.53
--Mimulus Ringens	56	11/4/01 12:42 PM	11/4/01 2:27 PM	1:45	2	1.14	11/5/01 11:26 AM	20:59	0	0.00
--Penthorum Sedoides	57	11/4/01 12:42 PM	11/4/01 2:26 PM	1:44	2	1.15	11/5/01 11:25 AM	20:59	138	6.58
--Asclepias Incarnata	61	11/4/01 12:45 PM	11/4/01 2:30 PM	1:45	86	49.14	11/5/01 11:28 AM	20:58	71	3.39
	62	11/4/01 12:47 PM	11/4/01 2:31 PM	1:44	18	10.38	11/5/01 11:29 AM	20:58	90	4.29
	63	11/4/01 12:48 PM	11/4/01 2:32 PM	1:44	11	6.35	11/5/01 11:30 AM	20:58	91	4.34
Plot 14										
--Carex Cristatella	64	11/4/01 12:50 PM	11/4/01 2:33 PM	1:43	74	43.11	11/5/01 11:32 AM	20:59	184	8.77
--Carex Valpinoidea	65	11/4/01 12:52 PM	11/4/01 2:34 PM	1:42	225	132.35	11/5/01 11:32 AM	20:58	225	10.73
--Penthorum Sedoides	66	11/4/01 12:53 PM	11/4/01 2:34 PM	1:41	225	133.66	11/5/01 11:32 AM	20:58	225	10.73
--Mimulus Ringens										
--Asclepias Incarnata										

\*\* indicates possible candidate for well development efforts

Bold numbers indicate that well was completely recovered in elapsed time. No numbers higher than 225mL (total volume of well and tube)

**Recovery Tests after Development (Strata B)**

Plant Species	Middle Strata	First Purge	Second Purge	Elapsed Time (1 2)	Volume (mL)	Recovery Rate (mL/hr)	Third Purge	Fourth Purge	Elapsed Time (3-4)	Volume (mL)	Recovery Rate (mL/hr)
--Carex Hystercina	Plot 1										
	1										
	2										
	3										
	7										
	8										
	9										
	Plot 2										
	4										
--Scirpus Atrovirens	5										
	6										
	10										
	11	11/8/01 11:52 AM	11/9/01 4:15 PM	28:23:00	266	9.37	11/11/01 9:41 AM	11/11/01 10:40 AM	0:59:00	176	178.98
	12										
	Plot 3										
--Eleocharis Erythropoda	13										
	14										
	15										
	19										
	20										
	21										
--Carex Comosa	Plot 4										
	16										
	17										
	18										
	22										
	23										
--Aeorus Calamus	Plot 5										
	24										
	25										
	26										
	27	11/8/01 12:24 PM	11/9/01 3:48 PM	27:24:00	202	7.37	11/11/01 9:53 AM	11/11/01 10:50 AM	0:57:00	154	162.11
	31										
Plot 6	32										
	33										
	Plot 7										
--Eleocharus Acicularis	28										
	29										
	30										
	Plot 7										
--Carex Cristatella	37										
	38										
	39										



# Recovery Tests after Development (Strata B)

Plant Species	Middle Strata Plot	First Purge	Second Purge	Elapsed Time (1 2)	Volume (mL)	Recovery Rate (mL/hr)	Third Purge	Fourth Purge	Elapsed Time (3-4)	Volume (mL)	Recovery Rate (mL/hr)
--Effusus	35										
--Scirpus Validus	36										
	40										
	41										
	42										
<b>Plot 9</b>											
--Carex Valpinoidea	43										
--(Mix)	44	11/8/01 10:43 AM	11/9/01 3:19 PM	28:36:00	183	6.40	11/11/01 10:05 AM	11/11/01 11:02 AM	0:57:00	105	110.53
	45										
<b>Plot 10</b>											
--Juncus Torreyi	46										
--Juncus Dudleyi	47	11/8/01 11:08 AM	11/9/01 3:10 PM	28:02:00	298	10.63	11/11/01 10:09 AM	11/11/01 11:08 AM	0:59:00	204	207.46
--Carex Lupiformis	48	37203.45903	11/9/01 3:06 PM	11/00 4:05 AM	0:00	0.89021	37206.42	11/11/01 11:09 AM	0:58	0	0.00
<b>Plot 11</b>											
--(Mix)	49										
	50	11/8/01 10:13 AM	11/9/01 3:02 PM	28:49:00	136	4.72	11/11/01 10:14 AM	11/11/01 11:12 AM	0:58:00	31	32.07
	51										
<b>Plot 12</b>											
--(Blank)	52	11/8/01 10:05 AM	11/9/01 2:43 PM	28:38:00	156	5.45	11/11/01 10:17 AM	11/11/01 11:17 AM	1:00:00	192	192.00
	53										
	54										
	58										
	59	11/8/01 9:22 AM	11/9/01 2:32 PM	29:10:00	167	5.73	11/11/01 10:27 AM	11/11/01 11:30 AM	1:03:00	176	167.62
	60										
<b>Plot 13</b>											
--Carex Hystercina	55	11/8/01 9:54 AM	11/9/01 2:16 PM	28:22:00	443	15.62	11/11/01 10:20 AM	11/11/01 11:20 AM	1:00:00	283	283.00
--Mimulus Ringens	56	11/8/01 9:40 AM	11/9/01 2:18 PM	28:38:00	107	3.74	11/11/01 10:22 AM	11/11/01 11:22 AM	1:00:00	8	8.00
--Penthorum Sedoides	57										
--Asclepias Incarnata	61										
	62										
	63										
<b>Plot 14</b>											
--Carex Cristatella	64										
--Carex Valpinoidea	65										
--Penthorum Sedoides	66										
--Mimulus Ringens											
--Asclepias Incarnata											

## Appendix F: Wetland Preparation & Sampling Equipment

<b>Nomenclature</b>	<b>Supplier</b>	<b>Supplier Catalog Number</b>	<b>Quantity</b>
¼" O.D. X 1/8" I.D Teflon tubing (100ft/case)	Fisher Scientific	14-179-6	1
60mL PPE syringe			
3-way polycarbonate cockstop			
100mL jumbo glass syringe with luer lock	Cole-Parmer	25701-01	3
Teflon Male luer lock to 1/8" hose barb			
Tubing cutter			
DI water reservoir (1 gallon, plastic jug)			
Vial tray (holds 24-40mL vials)			
10 quart collapsible cooler with shoulder straps			
40mL glass vials with septum and cap			
Union, straight 1/4"	Cole-Parmer	P-06334-22	3
Fittings, Luer, F, 1/8" (25/pk)	Cole-Parmer	P-06359-37	1
Luer, M slip X 1/8" barb (25/pk)	Cole-Parmer	P-30600-20	1
Tubing, PTFE, 3/16" X 1/4" X 12'	Cole-Parmer	P-06407-44	5
Stopcock, 3-way Male Lock (10/pk)	Cole-Parmer	P-30600-23	1
Luer, M slip X 1/8" Barb (25/pk)	Cole-Parmer	P-30600-20	1
Adapter, Rotating, Male/Male	Cole-Parmer	P-06464-90	5
615S Shielded Drive Point Piezometer, 6" SS c/w	Solinst	104366	92
615 1ft SS NPT Extension for the Drive Point Piez	Solinst	101069	23
615 2ft SS NPT Extension for the Drive Point Piez	Solinst	101070	23
615 3ft SS NPT Extension for the Drive Point Piez	Solinst	101071	23
615 5ft SS NPT Extension for the Drive Point Piez	Solinst	102077	23
615 Manual Slide Hammer-25lb for the Drive Poin	Solinst	102077	1
615 Manual Drive Head Assembly for the Drive Po	Solinst	102174	1
615 SS NPT Cap for the Drive Point Piezometer	Solinst	101057	92
615 SS NPT Coupling for the Drive Point Piezome	Solinst	100620	92
410 Peristaltic Pump	Solinst	104028	1
404 SS10 Footvalve for WaTerra Pump	Solinst	101284	1
407/408 3/8" X 1/4" single line LDPE Tubing	Solinst	100422	10
615 5/8" X 1/2" Teflon lined LDPE Tubing	Solinst	103614	300
Marker, Shapie Black (dozen)	GSA	7520003126124	1
Hammer, curved claw	GSA	5120011128349	1
Padlock	GSA	5340002920896	1
Saw, Circular, Portable	GSA	5130000893353	1
Needle Nose Pliers, straight	GSA	5120001849403	1
Duct tape, Silver gray	GSA	5640001032254	3
First Aid Kit	GSA	654006639032	1
Accounting Book, 7.75 X 12	GSA	7530002905028	3
Self Bracket, Enamel Coating	GSA	5340002402346	1
Blacksmith, Engineer Hammer	GSA	5120002034656	1
Safety glasses, tinted	GSA	4240012922817	4

<b><u>Nomenclature</u></b>	<b><u>Supplier</u></b>	<b><u>Supplier Catalog Number</u></b>	<b><u>Quantity</u></b>
32oz Heavy Duty PVC cement	Home Depot	177-950	1
3 pc pipe wrench set	Home Depot	597-515	1
Workmate 425	Home Depot	624-436	1
Closed Grip Hacksaw	Home Depot	842-757	1
12In/24T 10PK Moly Hacksaw blade	Home Depot	842-886	1
3 in. X 10 ft schedule 40 pvc pipe	Home Depot	193-860	2
3 in. coupling DWV CCPCS	Home Depot	189-030	10
3 in. 1/4 bend DWV pcs	Home Depot	189-480	5
1 X 10-8 #2 & BTR Pine S4S KD	Home Depot	914-908	30
1/2 in. X 300 ft. Fiberglass Tape	Home Depot	812-779	1
Scotch 700 Electric Tape -3/4" X 66'	Home Depot	735-473	3
7 1/4 in. 60T Hollow Ground-Bulk	Home Depot	358-023	6
100 ft 10/3 SJTWA Yellow Cord	Home Depot	866-886	1
50 Ft 10/3 SJTWA Yellow Cord	Home Depot	729-706	1
1X2-18in stakes-bundle	Home Depot	736-813	2
No. 18 X 800 Nylon Seine Twine	Home Depot	292-257	2
4D 1-1/2" Electro Galv. Roofing Nails 1lb	Home Depot	418-447	1
50lb-Fast setting Concrete Mix	Home Depot	842-303	5
Top Grain with Palm Patch Lg	Home Depot	474-152	6
Folding Sawhorse-2 pk	Home Depot	337-242	2
14.4V Cordless Reciprocating Saw	Home Depot	788-039	1
Ugly Recipro saw blade	Home Depot	739-368	6
Trash Can 20 Gal Roughneck Mocha	Home Depot	737-275	1
Glad 33 Gal 50 Ct trashbags	Home Depot	769-595	1
Ear Plugs, Foam 60 pair	Home Depot	734-404	1
WISS Snip w/ holster	Home Depot	206-699	1
Coleman 50 quart cooler	Walmart		2
Everstart Deep cycle Marine Battery	Walmart		1
Trickle Battery Charger, Everstart	Walmart		1
Rigid 1/2 X 3/4 NPT Dies for SS	Pikrel Bros., INC		1
615 5/8" X 1/2" Teflon lined LDPE Tubing	Solinst	103614	250
615S Shielded Drive Point Piezometer, 6" SS c/w	Solinst	104366	15

## Appendix G: Analysis Equipment

<b><u>Nomenclature</u></b>	<b><u>Supplier</u></b>	<b><u>Supplier Catalog Number</u></b>	<b><u>Quantity</u></b>
Nitrate Standard, 1000ppm (500ml)	Fisher Scientific	LC17920-1	1
Fluoride Standard, 1000ppm (500ml)	Fisher Scientific	LC14600-1	1
Serum Bottle, 60mL (144/case)	Fisher Scientific	06-406H	1
Aluminum Seal w/hole	Fisher Scientific	11-126-12	1
Seal Crimper H207, 20 mm	Fisher Scientific	10-319-490	1
Stopper, Butyl Rubber, Teflon faced	Fisher Scientific	06-451-53	1
Needle Bevl 25guage, 1-1/2" (100/pk)	Fisher Scientific	14-826-49	1
Funnel	Fisher Scientific	10-373A	2
50ml volumetric flask	Fisher Scientific	5640-50	6
Syringe, Luer Lock, 10 ml	Cole-Parmer	P-07939-84	2
Syringe Filters, 0.45µm (100/bx)	Cole-Parmer	P-29550-10	3
Syringe Filters, 0.45µm (50/bx)	Cole-Parmer	P-02915-06	1
Liqui-nox Solution, Qt (12Qt/case)	Cole-Parmer	P-17778-00	1
Acetic Acid Solutions (100ml)	Sigma-Aldrich	40512-100ML-S	2
Formic Acid Sodium (500g)	Sigma-Aldrich	F6502-500G	1
Decapper 20 mm, hand operated	Fisher Scientific	06-451-132	1
Grade 5.0, Helium	BOC Gases	RS-33102400300	2
Prod, D6, Kit, Lan/10bt, 512K	Dionex	057007	1
Prod, D6, Kit, Lan/10bt, 000K, GP/GS	Dionex	057005	1
Prod, D5, Cell, Cond, AS50, TC	Dionex	055400	1
Prod, D6, AS50PK-IV+SP-ST+TC-CS	Dionex	056845	1
Prod, D6, CD25A, W/O Cell	Dionex	057827	1
Prod, D6, GP50-2, PK, SB, -DGAS	Dionex	057684	1
Prod, Col, IP AS11-HC 4mm	Dionex	052960	1
Bottle, w/cap, wide mth, 250ml	Dionex	043494	1
Prod, Eluent Organizer, Ste/4X2P	Dionex	054468	1
Prod, PN6, PN-2	Dionex	057587	1
Service Agreement	Dionex	057759	1
Application	Dionex	038677	1
CBL, 3 Cond, Li	Dionex	960708	4
Prod, Gas Assistance Kit	Dionex	056886	1
Prod, Col, IP ATC-1	Dionex	037151	1
Prod, Mem, ASRS-Ultra 4mm	Dionex	053946	1
Prod, Col, IP AG11-HC 4 mm	Dionex	052962	1
Printer, HP LJ 1100XI w/cable	Dionex	055515	1
Prod, D6, EG40, +EGC/KOH	Dionex	056971	1
Agreement, SVC, Premier Care Program, DX500	Dionex	029062	1
Belkin 6-ft Printer Cable	Walmart		1
Assy, Sample Loop, 100µL, Peek	Dionex	042951	1
Assy, Sample Loop, 50mL, Peek	Dionex	042950	1
Syringe, 1000uL, Kloehe	Dionex	055066	1
Syringe, 250uL, Kloehe	Dionex	053916	1
Tubing, Pk, .030 ID 20 ft	Dionex	052304	1
Tubing, Pk, .010 ID 5 ft	Dionex	052306	1
Prod, Kit, Install, MMS/SRS EXT R	Dionex	038018	1
Assy, Kit, Quick Start, Silk	Dionex	059220	1
Prod, Vial+cap+silt Septa, 1.5ml	Dionex	055427	6
Assy, Tray, 2 ml, Cast, AS50	Dionex	055057	1
Prod, Vial Kit, 10ml, PLAS, PK/100	Dionex	055058	8
Assy, Sample Loop, 250ul, Peek	Dionex	042953	1

## Appendix H: Dionex Analysis Program for PeakNet 6.0

	Pressure.LowerLimit =	200
	Pressure.UpperLimit =	2500
	%A. Equate =	"Water"
	%B. Equate =	"%B"
	%C. Equate =	"%C"
	%D. Equate =	"%D"
	Flush	Volume = 100
	Wait	FlushState
	NeedleHeight =	5
	CutSegmentVolume =	10
	SyringeSpeed =	3
	ColumnTemperature =	30
	Cycle =	0
	Data_Collection_Rate =	2.0
	Temperature_Compensation =	1.7
	Oven_Temperature =	30
	Suppressor_Type =	SRS
	Suppressor_Current =	100
	Flow =	1.50
	%B =	0.0
	%C =	0.0
	%D =	0.0
	Pump.Curve =	5
	WaitForTemperature =	False
	Wait	SamplePrep
- 0.100	; this negative step is for command traffic	
	Concentration =	1.00
	EluentGenerator.Curve =	5
0.000	ECD.Autozero	
	Load	
	Wait	CycleTimeState
	Inject	
	Wait	InjectState
	ECD_1.AcqOn	
	Concentration =	1.00
	EluentGenerator.Curve =	5
8.000	Concentration =	1.000
	EluentGenerator.Curve =	5

28.000	Concentration = EluentGenerator.Curve =	30.000 5
38.000	Concentration = EluentGenerator.Curve =	60.000 5
38.000	ECD_1.AcqOff Concentration = EluentGenerator.Curve =	60.000 5
38.100	Concentration = EluentGenerator.Curve =	1.000 5
41.500	Concentration = EluentGenerator.Curve =	1.000 5
	Wait	
	End	

### Appendix I: Acetate, Strata A

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	A	16-Jan-02	1	8.65	0.0005	0	0.0128
1	A	17-Jan-02	1	8.517	0.0061	0.02	0.1578
1	A	23-Jan-02	1	8.667	0.0005	0	0.0117
2	A	16-Jan-02	1	8.55	0.0035	0.01	0.091
2	A	17-Jan-02	1	8.492	0.005	0.02	0.1307
2	A	23-Jan-02	1	8.575	0.0009	0	0.0235
3	A	18-Jan-02	1	8.442	0.0255	0.09	0.6612
3	A	16-Jan-02	1	8.467	0.0645	0.22	1.6703
3	A	17-Jan-02	1	8.417	0.0469	0.16	1.216
4	A	18-Jan-02	2	8.492	0.0046	0.02	0.1187
4	A	16-Jan-02	2	8.5	0.0055	0.02	0.1433
4	A	17-Jan-02	2	8.458	0.0042	0.02	0.1098
5	A	18-Jan-02	2	8.458	0.0177	0.06	0.4588
5	A	16-Jan-02	2	8.467	0.0167	0.06	0.4326
5	A	17-Jan-02	2	8.425	0.0178	0.06	0.4614
6	A	18-Jan-02	2	8.467	0.0427	0.16	1.1069
6	A	16-Jan-02	2	8.483	0.0359	0.13	0.9303
6	A	17-Jan-02	2	8.433	0.0549	0.19	1.4232
7	A	17-Jan-02	1	8.483	0.008	0.03	0.2084
7	A	23-Jan-02	1	8.508	0.0121	0.04	0.3123
8	A	18-Jan-02	1	8.442	0.0099	0.03	0.2569
8	A	16-Jan-02	1	8.45	0.0077	0.03	0.1982
8	A	17-Jan-02	1	8.45	0.0101	0.03	0.2621
9	A	18-Jan-02	1	8.492	0.0215	0.08	0.5573
9	A	16-Jan-02	1	8.492	0.003	0.01	0.0779
9	A	17-Jan-02	1	8.492	0.0012	0	0.0319
10	A	18-Jan-02	2	8.517	0.0005	0	0.0141
10	A	10-Jan-02	2	N/D	N/D	N/D	N/D
10	A	16-Jan-02	2	N/D	N/D	N/D	N/D
10	A	14-Jan-02	2	8.733	0	0	0.0004
11	A	18-Jan-02	2	8.458	0.0397	0.14	1.0287
11	A	10-Jan-02	2	8.875	0.0001	0	0.0023
11	A	16-Jan-02	2	8.483	0.0378	0.14	0.9799
11	A	14-Jan-02	2	8.575	0.0486	0.17	1.258
12	A	18-Jan-02	2	8.458	0.0412	0.15	1.0661
12	A	10-Jan-02	2	8.492	0.0173	0.06	0.4486
12	A	16-Jan-02	2	8.467	0.0404	0.14	1.0472
13	A	18-Jan-02	3	8.492	0.302	1.05	7.8223
13	A	16-Jan-02	3	8.483	0.3018	1.02	7.8176
13	A	17-Jan-02	3	8.483	0.3766	1.29	9.7553
14	A	18-Jan-02	3	8.45	0.1786	0.63	4.6265

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
14	A	23-Jan-02	3	8.442	0.1542	0.52	3.9949
14	A	14-Jan-02	3	8.583	0.1387	0.5	3.5935
15	A	18-Jan-02	3	8.442	0.1047	0.37	2.713
15	A	17-Jan-02	3	8.475	0.1011	0.37	2.6183
15	A	23-Jan-02	3	8.458	0.052	0.19	1.3478
16	A	18-Jan-02	4	8.475	0	0	0.0003
16	A	10-Jan-02	4	8.625	0.0017	0.01	0.0431
16	A	23-Jan-02	4	8.517	0.0005	0	0.014
17	A	17-Jan-02	4	8.433	0.0481	0.17	1.2466
17	A	18-Jan-02	4	8.608	0.0445	0.15	1.1536
17	A	23-Jan-02	4	8.433	0.0324	0.11	0.8386
18	A	18-Jan-02	4	8.558	0.0072	0.02	0.1854
18	A	23-Jan-02	4	8.45	0.0055	0.02	0.1434
18	A	14-Jan-02	4	8.617	0.0051	0.02	0.1328
19	A	17-Jan-02	3	8.458	0.1183	0.42	3.0651
19	A	18-Jan-02	3	8.517	0.1307	0.44	3.3848
19	A	24-Jan-02	3	8.425	0.112	0.38	2.901
20	A	10-Jan-02	3	8.625	0.0017	0.01	0.0435
20	A	18-Jan-02	3	8.567	0.0014	0.01	0.0352
20	A	23-Jan-02	3	8.533	0.0019	0.01	0.0496
21	A	10-Jan-02	3	8.608	0.0427	0.15	1.107
21	A	18-Jan-02	3	8.55	0.0254	0.1	0.6585
21	A	23-Jan-02	3	8.5	0.0158	0.06	0.4087
22	A	10-Jan-02	4	8.617	0.0009	0	0.0236
22	A	18-Jan-02	4	8.575	0.0006	0	0.0151
22	A	23-Jan-02	4	8.542	0.0006	0	0.0166
23	A	10-Jan-02	4	8.533	0.0435	0.13	1.1278
23	A	18-Jan-02	4	8.442	0.0369	0.12	0.957
23	A	14-Jan-02	4	8.583	0.0177	0.06	0.4573
24	A	10-Jan-02	4	8.533	0.017	0.05	0.4415
24	A	18-Jan-02	4	8.45	0.0156	0.05	0.4044
24	A	14-Jan-02	4	8.517	0.0086	0.03	0.2228
25	A	10-Jan-02	5	8.592	0.0071	0.03	0.1827
25	A	18-Jan-02	5	8.517	0.001	0	0.027
25	A	23-Jan-02	5	8.633	0	0	0.0004
26	A	17-Jan-02	5	8.417	0.0346	0.12	0.8969
26	A	18-Jan-02	5	8.442	0.0297	0.1	0.7697
26	A	23-Jan-02	5	8.442	0.0363	0.13	0.9403
27	A	18-Jan-02	5	8.475	0.077	0.27	1.9946
27	A	23-Jan-02	5	8.467	0.0611	0.23	1.5818
27	A	14-Jan-02	5	8.558	0.0698	0.25	1.8093
28	A	10-Jan-02	6	8.5	0.042	0.12	1.087
28	A	18-Jan-02	6	8.417	0.0502	0.13	1.3011
28	A	23-Jan-02	6	8.825	0	0	0.0005
29	A	10-Jan-02	6	8.642	0	0	0.0004



Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
29	A	18-Jan-02	6	8.558	0.0004	0	0.0109
29	A	23-Jan-02	6	N/D	N/D	N/D	N/D
30	A	10-Jan-02	6	8.592	0.0021	0.01	0.0554
30	A	18-Jan-02	6	8.525	0.0003	0	0.007
30	A	24-Jan-02	6	8.508	0.0007	0	0.0186
31	A	10-Jan-02	5	8.45	0.0196	0.06	0.5072
31	A	18-Jan-02	5	8.442	0.0229	0.07	0.5931
31	A	14-Jan-02	5	8.55	0.0101	0.04	0.2606
32	A	17-Jan-02	5	8.583	0.0046	0.02	0.119
32	A	18-Jan-02	5	8.442	0.0034	0.01	0.0887
32	A	23-Jan-02	5	8.417	0.0034	0.01	0.087
33	A	18-Jan-02	5	8.492	0.009	0.03	0.2331
33	A	23-Jan-02	5	8.492	0.0068	0.03	0.1772
33	A	14-Jan-02	5	8.567	0.0111	0.04	0.287
34	A	22-Jan-02	8	8.633	0.0033	0.01	0.0852
34	A	10-Jan-02	8	8.508	0.0034	0.01	0.0894
34	A	24-Jan-02	8	8.442	0.0023	0.01	0.0599
35	A	22-Jan-02	8	8.617	0.0007	0	0.0192
35	A	10-Jan-02	8	8.525	0	0	0.0003
35	A	24-Jan-02	8	8.675	0	0	0.0011
36	A	17-Jan-02	8	8.608	0.0127	0.05	0.329
36	A	22-Jan-02	8	8.6	0.01	0.04	0.2581
36	A	24-Jan-02	8	8.483	0.0041	0.02	0.1065
37	A	22-Jan-02	7	8.592	0.0006	0	0.0163
37	A	10-Jan-02	7	8.542	0.0017	0.01	0.0442
37	A	24-Jan-02	7	N/D	N/D	N/D	N/D
38	A	22-Jan-02	7	8.525	0.0305	0.11	0.7897
38	A	10-Jan-02	7	8.475	0.0361	0.12	0.935
38	A	24-Jan-02	7	8.433	0.028	0.1	0.7262
39	A	17-Jan-02	7	8.508	0.0122	0.04	0.3153
39	A	22-Jan-02	7	8.492	0.0164	0.06	0.4258
39	A	24-Jan-02	7	8.433	0.019	0.06	0.4933
40	A	17-Jan-02	8	8.475	0.0056	0.02	0.1441
40	A	22-Jan-02	8	8.467	0.0047	0.02	0.1227
40	A	24-Jan-02	8	8.4	0.0051	0.02	0.1332
41	A	22-Jan-02	8	8.458	0.0075	0.03	0.1937
41	A	10-Jan-02	8	8.467	0.0078	0.03	0.2008
41	A	24-Jan-02	8	8.833	0	0	0.0005
42	A	17-Jan-02	8	8.467	0.0069	0.02	0.1778
42	A	22-Jan-02	8	8.45	0.0065	0.02	0.1677
42	A	24-Jan-02	8	8.833	0	0	0.0003
43	A	22-Jan-02	9	8.475	0.0415	0.15	1.0746
43	A	10-Jan-02	9	8.467	0.0287	0.1	0.7444
43	A	14-Jan-02	9	8.517	0.0316	0.12	0.8188
44	A	22-Jan-02	9	8.45	0.0195	0.07	0.5039

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
44	A	10-Jan-02	9	8.45	0.0246	0.08	0.6374
44	A	14-Jan-02	9	8.433	0.0412	0.14	1.0681
45	A	22-Jan-02	9	N/D	N/D	N/D	N/D
45	A	10-Jan-02	9	8.458	0.0003	0	0.0065
45	A	24-Jan-02	9	8.425	0.0009	0	0.0235
46	A	17-Jan-02	10	8.475	0.0071	0.02	0.1834
46	A	22-Jan-02	10	8.433	0.0071	0.02	0.1846
46	A	24-Jan-02	10	8.425	0.0076	0.02	0.198
47	A	17-Jan-02	10	8.483	0.0484	0.17	1.254
47	A	22-Jan-02	10	8.425	0.0659	0.23	1.7076
47	A	24-Jan-02	10	8.417	0.0326	0.12	0.8446
48	A	22-Jan-02	10	8.425	0.0028	0.01	0.0718
48	A	10-Jan-02	10	8.467	0.0015	0.01	0.0395
48	A	14-Jan-02	10	8.533	0.0016	0.01	0.0426
49	A	22-Jan-02	11	8.442	0.0112	0.04	0.2911
49	A	10-Jan-02	11	8.45	0.0116	0.04	0.3008
49	A	24-Jan-02	11	N/D	N/D	N/D	N/D
50	A	22-Jan-02	11	8.45	0.0016	0.01	0.0424
50	A	10-Jan-02	11	8.75	0	0	0.0008
50	A	24-Jan-02	11	N/D	N/D	N/D	N/D
51	A	22-Jan-02	11	8.442	0.0035	0.01	0.0899
51	A	10-Jan-02	11	8.442	0.0051	0.02	0.131
51	A	24-Jan-02	11	N/D	N/D	N/D	N/D
52	A	17-Jan-02	12	8.542	0.0022	0.01	0.0572
52	A	22-Jan-02	12	8.5	0.0023	0.01	0.0604
52	A	24-Jan-02	12	N/D	N/D	N/D	N/D
53	A	17-Jan-02	12	8.55	0.0023	0.01	0.0597
53	A	22-Jan-02	12	8.533	0.0018	0.01	0.0472
53	A	24-Jan-02	12	N/D	N/D	N/D	N/D
54	A	22-Jan-02	12	8.417	0.0599	0.2	1.551
54	A	10-Jan-02	12	8.425	0.0584	0.21	1.5129
54	A	24-Jan-02	12	N/D	N/D	N/D	N/D
55	A	22-Jan-02	13	8.442	0.0206	0.07	0.5342
55	A	10-Jan-02	13	8.433	0.078	0.29	2.0215
55	A	24-Jan-02	13	N/D	N/D	N/D	N/D
56	A	17-Jan-02	13	8.483	0.2415	0.8	6.2566
56	A	22-Jan-02	13	8.425	0.2145	0.7	5.557
56	A	24-Jan-02	13	N/D	N/D	N/D	N/D
57	A	22-Jan-02	13	8.45	0.0609	0.23	1.5783
57	A	10-Jan-02	13	8.433	0.0818	0.3	2.1177
57	A	24-Jan-02	13	N/D	N/D	N/D	N/D
58	A	22-Jan-02	12	8.467	0.0421	0.16	1.0914
58	A	10-Jan-02	12	8.442	0.0641	0.25	1.6603
58	A	24-Jan-02	12	N/D	N/D	N/D	N/D
59	A	22-Jan-02	12	8.458	0.2506	0.85	6.4911

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
59	A	10-Jan-02	12	8.417	0.1944	0.68	5.0362
59	A	24-Jan-02	12	N/D	N/D	N/D	N/D
60	A	22-Jan-02	12	8.492	0.4936	1.61	12.786
60*	A	10-Jan-02	12	8.467	0.6457	2.09	16.726
60	A	14-Jan-02	12	8.533	0.4549	1.59	11.7839
61	A	22-Jan-02	13	8.458	0.2765	0.95	7.1627
61	A	10-Jan-02	13	8.458	0.5007	1.68	12.9705
61	A	14-Jan-02	13	8.508	0.2492	0.9	6.4545
62*	A	22-Jan-02	13	8.583	1.1686	3.57	30.2697
62*	A	10-Jan-02	13	8.6	1.7893	4.87	46.3474
62	A	24-Jan-02	13	N/D	N/D	N/D	N/D
63	A	22-Jan-02	13	8.508	0.294	1.03	7.6152
63	A	10-Jan-02	13	8.442	0.3158	1.08	8.1806
63*	A	14-Jan-02	13	8.575	1.0334	3.23	26.7688
64	A	22-Jan-02	14	8.475	0.1567	0.56	4.06
64	A	10-Jan-02	14	8.433	0.3427	1.2	8.8764
64	A	24-Jan-02	14	N/D	N/D	N/D	N/D
65	A	17-Jan-02	14	8.533	0.0078	0.03	0.201
65	A	22-Jan-02	14	8.517	0.0145	0.06	0.3755
65	A	24-Jan-02	14	N/D	N/D	N/D	N/D
66	A	17-Jan-02	14	8.483	0.1676	0.6	4.3412
66	A	23-Jan-02	14	8.442	0.2329	0.78	6.033
66	A	24-Jan-02	14	N/D	N/D	N/D	N/D

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix J: Acetate, Strata B

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1*	B	25-Jan-02	1	8.642	0.0925	0.34	2.4166
1*	B	17-Jan-02	1	8.517	0.1102	0.41	2.8796
1*	B	15-Jan-02	1	8.633	0.1205	0.44	3.148
2	B	25-Jan-02	1	8.5	0.0112	0.04	0.2914
2	B	13-Jan-02	1	8.6	0.0133	0.04	0.3472
2	B	15-Jan-02	1	8.517	0.0118	0.04	0.3086
3	B	25-Jan-02	1	8.533	0.0025	0.01	0.0661
3	B	13-Jan-02	1	8.617	0.0035	0.01	0.0904
3	B	15-Jan-02	1	8.6	0.0039	0.01	0.1017
4	B	25-Jan-02	2	8.542	0.0006	0	0.0168
4	B	13-Jan-02	2	8.617	0.0014	0.01	0.0362
4	B	15-Jan-02	2	8.625	0.0007	0	0.0172
5	B	25-Jan-02	2	8.467	0.0117	0.04	0.3058
5	B	17-Jan-02	2	8.458	0.0104	0.04	0.2719
5	B	15-Jan-02	2	8.525	0.0115	0.04	0.2992
6	B	25-Jan-02	2	8.45	0.0071	0.03	0.1848
6	B	13-Jan-02	2	8.55	0.0065	0.02	0.1691
6	B	15-Jan-02	2	8.525	0.0081	0.03	0.2114
7	B	25-Jan-02	1	8.483	0.002	0.01	0.0528
7	B	17-Jan-02	1	8.492	0.0039	0.01	0.1017
7	B	15-Jan-02	1	8.533	0.0054	0.02	0.1417
8	B	25-Jan-02	1	8.45	0.0054	0.02	0.1407
8	B	13-Jan-02	1	8.542	0.0068	0.02	0.1784
8	B	15-Jan-02	1	8.525	0.0061	0.02	0.1584
9	B	25-Jan-02	1	8.517	0.0004	0	0.0113
9	B	13-Jan-02	1	8.617	0.0004	0	0.0102
9	B	15-Jan-02	1	8.575	0.0003	0	0.0067
10	B	25-Jan-02	2	8.517	0	0	0.0005
10	B	13-Jan-02	2	8.617	0.0002	0	0.0049
10	B	15-Jan-02	2	N/D	N/D	N/D	N/D
11	B	25-Jan-02	2	8.45	0.0049	0.02	0.1275
11	B	13-Jan-02	2	8.542	0.0045	0.02	0.1166
11	B	15-Jan-02	2	8.508	0.0064	0.02	0.1672
12	B	25-Jan-02	2	8.425	0.0281	0.08	0.7339
12	B	13-Jan-02	2	8.508	0.0234	0.08	0.6103
12	B	15-Jan-02	2	8.483	0.0232	0.07	0.607
13	B	17-Jan-02	3	8.417	0.0386	0.13	1.0079
14	B	25-Jan-02	3	8.425	0.0258	0.08	0.6738
14	B	13-Jan-02	3	8.5	0.04	0.15	1.0441
14	B	15-Jan-02	3	8.483	0.0327	0.1	0.8553
15	B	25-Jan-02	3	8.417	0.0081	0.03	0.211
15	B	13-Jan-02	3	8.492	0.0174	0.06	0.4549
15	B	15-Jan-02	3	8.467	0.0158	0.05	0.4123
16	B	25-Jan-02	4	8.458	0.0078	0.03	0.2038

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
16	B	13-Jan-02	4	8.542	0.007	0.02	0.1816
16	B	15-Jan-02	4	8.525	0.0071	0.03	0.1849
17	B	25-Jan-02	4	8.408	0.009	0.03	0.2349
17	B	17-Jan-02	4	8.408	0.0091	0.03	0.2378
17	B	15-Jan-02	4	8.483	0.0146	0.04	0.3806
18	B	25-Jan-02	4	8.408	0.0279	0.09	0.7287
18	B	17-Jan-02	4	8.392	0.0303	0.09	0.7919
18	B	15-Jan-02	4	8.475	0.0471	0.13	1.2308
19	B	25-Jan-02	3	8.408	0.017	0.06	0.4436
19	B	17-Jan-02	3	8.408	0.0134	0.04	0.351
19	B	16-Jan-02	3	8.492	0.0575	0.19	1.5012
20	B	25-Jan-02	3	8.467	0.0009	0	0.024
20	B	13-Jan-02	3	N/D	N/D	N/D	N/D
20	B	15-Jan-02	3	8.575	0	0	0.0013
21	B	25-Jan-02	3	8.467	0.0021	0.01	0.0541
21	B	13-Jan-02	3	8.575	0.002	0.01	0.052
21	B	15-Jan-02	3	8.558	0.0022	0.01	0.0573
22	B	25-Jan-02	4	8.475	0.0004	0	0.0111
22	B	13-Jan-02	4	N/D	N/D	N/D	N/D
22	B	15-Jan-02	4	N/D	N/D	N/D	N/D
23	B	25-Jan-02	4	8.458	0.0218	0.08	0.5692
23	B	13-Jan-02	4	8.55	0.0157	0.06	0.4091
23	B	15-Jan-02	4	8.525	0.017	0.06	0.4434
24	B	25-Jan-02	4	8.442	0.0338	0.13	0.8825
24	B	13-Jan-02	4	8.492	0.0452	0.16	1.1804
24	B	15-Jan-02	4	8.492	0.0424	0.15	1.1065
25	B	25-Jan-02	5	8.45	0.0107	0.04	0.2801
25	B	13-Jan-02	5	8.508	0.0209	0.07	0.5463
25	B	15-Jan-02	5	8.492	0.0161	0.05	0.4201
26	B	25-Jan-02	5	8.433	0.0045	0.02	0.1176
26	B	13-Jan-02	5	8.483	0.0058	0.02	0.1507
26	B	15-Jan-02	5	8.467	0.0081	0.02	0.2112
27	B	25-Jan-02	5	8.417	0.0205	0.07	0.536
27	B	13-Jan-02	5	8.475	0.0189	0.06	0.4938
27	B	15-Jan-02	5	8.45	0.0194	0.06	0.5073
28	B	25-Jan-02	6	8.417	0.0263	0.08	0.686
28	B	13-Jan-02	6	8.467	0.0255	0.08	0.6667
28	B	15-Jan-02	6	8.45	0.0198	0.07	0.5184
29	B	25-Jan-02	6	8.5	0.0004	0	0.0102
29	B	13-Jan-02	6	8.567	0.0006	0	0.0148
29	B	15-Jan-02	6	8.567	0.0007	0	0.0179
30	B	25-Jan-02	6	8.433	0.0437	0.15	1.1415
30	B	13-Jan-02	6	8.492	0.0338	0.13	0.8822
30	B	15-Jan-02	6	8.508	0.044	0.15	1.1491
31	B	25-Jan-02	5	8.408	0.0673	0.24	1.759

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
31	B	13-Jan-02	5	8.483	0.064	0.21	1.6725
31	B	15-Jan-02	5	8.483	0.0787	0.27	2.0565
32	B	13-Jan-02	5	8.492	0.0274	0.09	0.7157
32	B	15-Jan-02	5	8.45	0.0302	0.1	0.7889
32	B	16-Jan-02	5	8.592	0.0071	0.02	0.185
33	B	25-Jan-02	5	8.483	0.0076	0.03	0.1973
33	B	13-Jan-02	5	8.55	0.0052	0.02	0.1361
33	B	15-Jan-02	5	8.525	0.0086	0.03	0.2236
34	B	16-Jan-02	8	8.525	0.0423	0.13	1.1057
34	B	26-Jan-02	8	8.567	0.0395	0.13	1.0325
34	B	13-Jan-02	8	8.642	0.0381	0.12	0.9967
35	B	16-Jan-02	8	8.592	0.0348	0.14	0.9087
35	B	26-Jan-02	8	8.583	0.0363	0.14	0.9486
35	B	13-Jan-02	8	8.683	0.0318	0.12	0.8313
36	B	16-Jan-02	8	8.525	0.0362	0.11	0.9465
36	B	26-Jan-02	8	8.508	0.0294	0.1	0.7693
36	B	13-Jan-02	8	8.608	0.0355	0.12	0.9283
37	B	26-Jan-02	7	8.483	0.0074	0.03	0.1923
37	B	13-Jan-02	7	8.575	0.0084	0.03	0.2205
37	B	23-Jan-02	7	8.525	0.01	0.03	0.2605
38	B	16-Jan-02	7	8.508	0.0007	0	0.0192
38	B	26-Jan-02	7	8.458	0.0018	0.01	0.0478
38	B	13-Jan-02	7	8.583	0.0032	0.01	0.0836
39	B	16-Jan-02	7	8.475	0.0288	0.1	0.752
39	B	26-Jan-02	7	8.45	0.0357	0.12	0.9326
39	B	13-Jan-02	7	8.542	0.0361	0.11	0.9432
40*	B	16-Jan-02	8	8.467	0.0628	0.22	1.6403
40	B	26-Jan-02	8	8.458	0.1018	0.35	2.6599
40	B	13-Jan-02	8	8.55	0.068	0.23	1.7773
41	B	16-Jan-02	8	8.475	0.0076	0.03	0.1978
41	B	26-Jan-02	8	8.442	0.0063	0.02	0.1653
41	B	13-Jan-02	8	8.533	0.0089	0.03	0.2332
42	B	16-Jan-02	8	8.492	0.0197	0.07	0.5138
42	B	26-Jan-02	8	8.442	0.0179	0.06	0.4671
42	B	13-Jan-02	8	8.533	0.0222	0.08	0.5801
43	B	16-Jan-02	9	8.458	0.0113	0.04	0.2944
43	B	26-Jan-02	9	8.417	0.0091	0.03	0.2374
43	B	13-Jan-02	9	8.508	0.01	0.03	0.262
44	B	16-Jan-02	9	8.475	0.0066	0.02	0.1726
44	B	26-Jan-02	9	8.442	0.0057	0.02	0.1477
44	B	13-Jan-02	9	8.542	0.0066	0.02	0.1714
45	B	16-Jan-02	9	8.492	0.0173	0.06	0.4533
45	B	26-Jan-02	9	8.442	0.0178	0.06	0.4659
45	B	13-Jan-02	9	8.55	0.0096	0.03	0.251
46	B	16-Jan-02	10	8.458	0.0191	0.06	0.4979

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
46	B	26-Jan-02	10	8.408	0.0176	0.06	0.4603
46	B	13-Jan-02	10	8.517	0.03	0.09	0.7851
47	B	16-Jan-02	10	8.475	0.0064	0.02	0.1684
47	B	26-Jan-02	10	8.417	0.0048	0.02	0.1255
47	B	13-Jan-02	10	8.5	0.0079	0.03	0.2051
48	B	15-Jan-02	10	8.517	0.0017	0.01	0.0447
48	B	16-Jan-02	10	8.508	0.0004	0	0.0098
48	B	13-Jan-02	10	8.583	0.0057	0.02	0.1478
49*	B	16-Jan-02	11	8.458	0.1536	0.51	4.0134
49	B	26-Jan-02	11	8.425	0.017	0.06	0.4444
49	B	13-Jan-02	11	8.5	0.0342	0.12	0.8928
50	B	26-Jan-02	11	8.433	0.0102	0.04	0.2676
50	B	13-Jan-02	11	8.508	0.0297	0.08	0.7771
50	B	23-Jan-02	11	8.483	0.0101	0.03	0.2634
51	B	16-Jan-02	11	8.483	0.0118	0.04	0.3081
51	B	26-Jan-02	11	8.467	0.0078	0.03	0.2043
51	B	13-Jan-02	11	8.558	0.0175	0.06	0.4581
52	B	16-Jan-02	12	8.483	0.0065	0.02	0.1687
52	B	26-Jan-02	12	8.475	0.0019	0.01	0.0497
52	B	13-Jan-02	12	8.55	0.0099	0.04	0.259
53	B	16-Jan-02	12	8.5	0.0031	0.01	0.0809
53	B	26-Jan-02	12	8.475	0.0041	0.02	0.1064
53	B	13-Jan-02	12	8.575	0.0027	0.01	0.0693
54	B	16-Jan-02	12	8.442	0.0422	0.15	1.1016
54	B	26-Jan-02	12	8.425	0.0385	0.14	1.0063
54	B	13-Jan-02	12	8.508	0.045	0.16	1.1744
55	B	16-Jan-02	13	8.433	0.0248	0.08	0.6477
55	B	26-Jan-02	13	8.417	0.026	0.08	0.6794
55	B	13-Jan-02	13	8.492	0.0288	0.09	0.7536
56	B	15-Jan-02	13	8.508	0.0048	0.02	0.1257
56	B	16-Jan-02	13	8.442	0.0002	0	0.0056
57	B	16-Jan-02	13	8.492	0.0054	0.02	0.1411
57	B	26-Jan-02	13	8.458	0.0044	0.02	0.1155
57	B	13-Jan-02	13	8.525	0.0054	0.02	0.1398
58	B	16-Jan-02	12	8.533	0.0009	0	0.0232
58	B	26-Jan-02	12	8.492	0.0012	0	0.031
58	B	13-Jan-02	12	8.567	0.0009	0	0.0234
59	B	16-Jan-02	12	8.45	0.0117	0.04	0.3049
59	B	26-Jan-02	12	8.442	0.0109	0.04	0.2856
59	B	13-Jan-02	12	8.492	0.0148	0.05	0.3863
60	B	16-Jan-02	12	8.425	0.0462	0.14	1.2075
60	B	26-Jan-02	12	8.433	0.0357	0.12	0.9328
60	B	13-Jan-02	12	8.45	0.0515	0.15	1.3455
61	B	16-Jan-02	13	8.433	0.0181	0.05	0.4731
61	B	26-Jan-02	13	8.425	0.0606	0.22	1.5844

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
61	B	13-Jan-02	13	8.442	0.0422	0.14	1.1029
62	B	16-Jan-02	13	8.433	0.0201	0.07	0.525
62	B	26-Jan-02	13	8.433	0.0211	0.07	0.5525
62	B	13-Jan-02	13	8.483	0.0224	0.07	0.5861
63	B	16-Jan-02	13	8.433	0.0701	0.25	1.8326
63	B	26-Jan-02	13	8.408	0.0208	0.07	0.5424
63	B	13-Jan-02	13	8.483	0.0734	0.26	1.9169
64	B	16-Jan-02	14	8.458	0.0268	0.09	0.6989
64	B	26-Jan-02	14	8.442	0.0206	0.07	0.5371
64	B	13-Jan-02	14	8.5	0.0274	0.1	0.7163
65	B	16-Jan-02	14	8.442	0.0122	0.06	0.3179
65	B	26-Jan-02	14	8.45	0.012	0.04	0.314
65	B	13-Jan-02	14	8.542	0.0114	0.04	0.297
66	B	16-Jan-02	14	8.45	0.0659	0.22	1.7223
66	B	26-Jan-02	14	8.425	0.0586	0.21	1.5309
66	B	13-Jan-02	14	8.483	0.0647	0.22	1.6916

\*—JMP 4.0 Outlier

N/D—Not Detected



### Appendix K: Acetate, Strata C

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	C	16-Jan-02	1	8.667	0.0003	0	0.0091
1	C	17-Jan-02	1	8.817	0	0	0.0003
1	C	26-Jan-02	1	8.65	0	0	0.0003
2	C	16-Jan-02	1	N/D	N/D	N/D	N/D
2	C	17-Jan-02	1	N/D	N/D	N/D	N/D
2	C	26-Jan-02	1	N/D	N/D	N/D	N/D
3	C	16-Jan-02	1	N/D	N/D	N/D	N/D
3	C	17-Jan-02	1	N/D	N/D	N/D	N/D
3	C	26-Jan-02	1	N/D	N/D	N/D	N/D
4	C	16-Jan-02	2	N/D	N/D	N/D	N/D
4	C	17-Jan-02	2	N/D	N/D	N/D	N/D
4	C	26-Jan-02	2	N/D	N/D	N/D	N/D
5	C	16-Jan-02	2	8.575	0.0001	0	0.0019
5	C	17-Jan-02	2	8.55	0	0	0.0001
5	C	26-Jan-02	2	N/D	N/D	N/D	N/D
7	C	16-Jan-02	1	8.808	0	0	0.0007
7	C	26-Jan-02	1	8.567	0.0003	0	0.0083
7	C	22-Jan-02	1	N/D	N/D	N/D	N/D
8	C	26-Jan-02	1	N/D	N/D	N/D	N/D
8	C	23-Jan-02	1	N/D	N/D	N/D	N/D
8	C	22-Jan-02	1	8.458	0.0001	0	0.0026
9	C	16-Jan-02	1	8.583	0.0023	0.01	0.0596
9	C	26-Jan-02	1	8.558	0.0002	0	0.0052
9	C	22-Jan-02	1	8.525	0.0002	0	0.0048
10	C	16-Jan-02	2	8.467	0	0	0.0003
10	C	26-Jan-02	2	8.592	0	0	0.0003
10	C	06-Jan-02	2	8.592	0	0	0.0005
11	C	16-Jan-02	2	8.608	0.0001	0	0.0031
11	C	26-Jan-02	2	N/D	N/D	N/D	N/D
11	C	06-Jan-02	2	8.617	0.0003	0.01	0.0069
12	C	16-Jan-02	2	8.583	0	0	0.0007
12	C	26-Jan-02	2	8.617	0	0	0.0009
12	C	23-Jan-02	2	N/D	N/D	N/D	N/D
13	C	16-Jan-02	3	N/D	N/D	N/D	N/D
13	C	10-Jan-02	3	8.808	0	0	0.0004
13	C	26-Jan-02	3	8.542	0	0	0.0001
14	C	10-Jan-02	3	N/D	N/D	N/D	N/D
14	C	26-Jan-02	3	8.608	0.0001	0	0.0027
14	C	23-Jan-02	3	N/D	N/D	N/D	N/D
15	C	10-Jan-02	3	8.608	0	0	0.0005
15	C	26-Jan-02	3	N/D	N/D	N/D	N/D
15	C	23-Jan-02	3	N/D	N/D	N/D	N/D
16	C	10-Jan-02	4	8.592	0	0	0.0009

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
16	C	26-Jan-02	4	8.517	0.0001	0	0.0024
16	C	06-Jan-02	4	8.642	0.0001	0	0.0013
17	C	10-Jan-02	4	N/D	N/D	N/D	N/D
17	C	26-Jan-02	4	N/D	N/D	N/D	N/D
17	C	23-Jan-02	4	N/D	N/D	N/D	N/D
18	C	10-Jan-02	4	N/D	N/D	N/D	N/D
18	C	26-Jan-02	4	N/D	N/D	N/D	N/D
18	C	23-Jan-02	4	8.55	0	0	0.0006
19	C	16-Jan-02	3	8.583	0.0003	0	0.0069
19	C	10-Jan-02	3	8.658	0.0005	0	0.0139
20	C	16-Jan-02	3	N/D	N/D	N/D	N/D
20	C	10-Jan-02	3	N/D	N/D	N/D	N/D
20	C	26-Jan-02	3	8.575	0.0002	0	0.0061
21	C	10-Jan-02	3	8.658	0	0	0.0006
21	C	26-Jan-02	3	8.675	0.0002	0	0.004
21	C	06-Jan-02	3	8.617	0	0	0.0006
22	C	05-Jan-02	4	8.592	0	0	0.0012
22	C	10-Jan-02	4	N/D	N/D	N/D	N/D
22	C	06-Jan-02	4	8.617	0.0003	0	0.0078
23	C	05-Jan-02	4	8.617	0	0	0.0007
23	C	10-Jan-02	4	8.667	0	0	0.0004
23	C	06-Jan-02	4	8.583	0.0001	0	0.0017
24	C	05-Jan-02	4	8.608	0.0001	0	0.0016
24	C	10-Jan-02	4	8.567	0	0	0.0004
24	C	06-Jan-02	4	8.625	0.0006	0	0.0149
25	C	05-Jan-02	5	N/D	N/D	N/D	N/D
25	C	10-Jan-02	5	N/D	N/D	N/D	N/D
25	C	28-Jan-02	5	8.625	0	0	0.0006
26	C	10-Jan-02	5	8.65	0	0	0.0003
26	C	28-Jan-02	5	N/D	N/D	N/D	N/D
26	C	23-Jan-02	5	8.508	0	0	0.0003
27	C	10-Jan-02	5	N/D	N/D	N/D	N/D
27	C	28-Jan-02	5	8.675	0	0	0.0003
27	C	23-Jan-02	5	8.517	0.0018	0.01	0.047
28	C	05-Jan-02	6	8.667	0	0	0.0005
28	C	10-Jan-02	6	8.6	0	0	0.0004
28	C	06-Jan-02	6	N/D	N/D	N/D	N/D
29*	C	05-Jan-02	6	8.575	0.0032	0.01	0.0841
29*	C	10-Jan-02	6	8.65	0.0042	0.02	0.1098
29*	C	06-Jan-02	6	8.633	0.0081	0.03	0.2121
30	C	05-Jan-02	6	8.608	0.0003	0	0.0076
30	C	10-Jan-02	6	N/D	N/D	N/D	N/D
30	C	06-Jan-02	6	8.6	0.0001	0	0.0019
31	C	05-Jan-02	5	8.542	0	0	0.0013

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
31	C	10-Jan-02	5	8.692	0	0	0.0008
31	C	28-Jan-02	5	N/D	N/D	N/D	N/D
32	C	10-Jan-02	5	N/D	N/D	N/D	N/D
32	C	28-Jan-02	5	8.558	0	0	0.0005
32	C	23-Jan-02	5	N/D	N/D	N/D	N/D
33	C	10-Jan-02	5	8.617	0.0007	0	0.0189
33	C	28-Jan-02	5	8.508	0	0	0.0009
33	C	23-Jan-02	5	N/D	N/D	N/D	N/D
34	C	05-Jan-02	8	8.675	0	0	0.001
34	C	10-Jan-02	8	N/D	N/D	N/D	N/D
34	C	06-Jan-02	8	8.658	0	0	0.0004
35	C	05-Jan-02	8	8.633	0.0001	0	0.0027
35	C	10-Jan-02	8	8.6	0	0	0.0004
35	C	06-Jan-02	8	8.642	0	0	0.0007
36	C	05-Jan-02	8	8.65	0.001	0	0.0271
36	C	10-Jan-02	8	8.617	0	0	0.0001
36	C	06-Jan-02	8	8.65	0	0	0.0004
37	C	05-Jan-02	7	8.608	0.0002	0	0.0039
37	C	10-Jan-02	7	8.667	0	0	0.0005
37	C	28-Jan-02	7	8.45	0.0008	0	0.0217
37	C	06-Jan-02	7	8.708	0	0	0.0009
38	C	10-Jan-02	7	N/D	N/D	N/D	N/D
38	C	28-Jan-02	7	8.525	0.0002	0	0.0058
38	C	06-Jan-02	7	8.625	0	0	0.0004
39	C	10-Jan-02	7	8.625	0	0	0.0003
39	C	28-Jan-02	7	N/D	N/D	N/D	N/D
39	C	23-Jan-02	7	N/D	N/D	N/D	N/D
40	C	10-Jan-02	8	8.625	0	0	0.0003
40	C	28-Jan-02	8	N/D	N/D	N/D	N/D
40	C	23-Jan-02	8	N/D	N/D	N/D	N/D
41	C	10-Jan-02	8	8.583	0	0	0.0007
41	C	28-Jan-02	8	8.517	0	0	0.0003
41	C	06-Jan-02	8	8.458	0	0	0.0004
42	C	10-Jan-02	8	N/D	N/D	N/D	N/D
42	C	28-Jan-02	8	8.617	0	0	0.0004
42	C	23-Jan-02	8	N/D	N/D	N/D	N/D
43	C	10-Jan-02	9	8.65	0	0	0.0003
43	C	28-Jan-02	9	8.433	0	0	0.0007
43	C	06-Jan-02	9	8.642	0.0004	0	0.0095
44	C	10-Jan-02	9	N/D	N/D	N/D	N/D
44	C	28-Jan-02	9	N/D	N/D	N/D	N/D
44	C	23-Jan-02	9	8.567	0.0001	0.01	0.0031
45	C	10-Jan-02	9	N/D	N/D	N/D	N/D
45	C	28-Jan-02	9	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
45	C	23-Jan-02	9	8.525	0	0	0.0004
46	C	28-Jan-02	10	N/D	N/D	N/D	N/D
46	C	10-Jan-02	10	8.625	0	0	0.0004
46	C	23-Jan-02	10	N/D	N/D	N/D	N/D
47	C	28-Jan-02	10	N/D	N/D	N/D	N/D
47	C	10-Jan-02	10	N/D	N/D	N/D	N/D
47	C	23-Jan-02	10	N/D	N/D	N/D	N/D
48	C	28-Jan-02	10	N/D	N/D	N/D	N/D
48	C	10-Jan-02	10	8.65	0	0	0.0006
48	C	06-Jan-02	10	8.642	0	0	0.001
49	C	28-Jan-02	11	8.5	0.001	0	0.0252
49	C	10-Jan-02	11	8.675	0	0	0.0008
49	C	06-Jan-02	11	N/D	N/D	N/D	N/D
50	C	28-Jan-02	11	N/D	N/D	N/D	N/D
50	C	10-Jan-02	11	N/D	N/D	N/D	N/D
50	C	06-Jan-02	11	8.5	0.0001	0	0.0015
51	C	28-Jan-02	11	N/D	N/D	N/D	N/D
51	C	10-Jan-02	11	N/D	N/D	N/D	N/D
51	C	06-Jan-02	11	8.625	0	0	0.0003
52	C	28-Jan-02	12	N/D	N/D	N/D	N/D
52	C	10-Jan-02	12	8.675	0.0001	0	0.0031
52	C	23-Jan-02	12	N/D	N/D	N/D	N/D
53	C	28-Jan-02	12	8.517	0.0002	0	0.0055
53	C	10-Jan-02	12	8.658	0	0	0.0007
53	C	23-Jan-02	12	8.383	0	0	0.0003
54	C	28-Jan-02	12	N/D	N/D	N/D	N/D
54	C	10-Jan-02	12	8.658	0.0007	0	0.018
54	C	23-Jan-02	12	N/D	N/D	N/D	N/D
55	C	28-Jan-02	13	8.667	0	0	0.0004
55	C	10-Jan-02	13	8.642	0	0	0.0005
55	C	23-Jan-02	13	N/D	N/D	N/D	N/D
56	C	28-Jan-02	13	N/D	N/D	N/D	N/D
56	C	10-Jan-02	13	N/D	N/D	N/D	N/D
56	C	23-Jan-02	13	8.508	0	0	0.0003
57	C	28-Jan-02	13	N/D	N/D	N/D	N/D
57	C	10-Jan-02	13	8.625	0.0001	0	0.0016
57	C	23-Jan-02	13	N/D	N/D	N/D	N/D
58	C	28-Jan-02	12	N/D	N/D	N/D	N/D
58*	C	10-Jan-02	12	8.617	0.004	0.02	0.104
58	C	23-Jan-02	12	N/D	N/D	N/D	N/D
59	C	28-Jan-02	12	8.775	0	0	0.0004
59	C	10-Jan-02	12	8.625	0	0	0.0004
59	C	23-Jan-02	12	N/D	N/D	N/D	N/D
60	C	28-Jan-02	12	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
60	C	10-Jan-02	12	8.658	0	0	0.001
60	C	06-Jan-02	12	8.625	0.0002	0	0.0047
61	C	28-Jan-02	13	N/D	N/D	N/D	N/D
61	C	10-Jan-02	13	8.667	0	0	0.0003
61	C	23-Jan-02	13	N/D	N/D	N/D	N/D
62	C	28-Jan-02	13	N/D	N/D	N/D	N/D
62	C	10-Jan-02	13	N/D	N/D	N/D	N/D
62	C	23-Jan-02	13	N/D	N/D	N/D	N/D
63	C	28-Jan-02	13	N/D	N/D	N/D	N/D
63	C	10-Jan-02	13	N/D	N/D	N/D	N/D
63	C	23-Jan-02	13	N/D	N/D	N/D	N/D
64	C	28-Jan-02	14	N/D	N/D	N/D	N/D
64	C	10-Jan-02	14	N/D	N/D	N/D	N/D
64	C	23-Jan-02	14	8.508	0.0002	0	0.0042
65	C	28-Jan-02	14	8.508	0	0	0.0003
65	C	10-Jan-02	14	8.658	0	0	0.0004
65	C	23-Jan-02	14	8.492	0.0001	0	0.0015
66	C	28-Jan-02	14	N/D	N/D	N/D	N/D
66	C	10-Jan-02	14	8.6	0	0	0.0003
66	C	23-Jan-02	14	N/D	N/D	N/D	N/D

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix L: Acetate, Field Blanks, Influent and Effluent

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
Effluent	EFFLUENT	05-Jan-02	E	8.617	0.0009	0	0.0241
Effluent	EFFLUENT	10-Jan-02	E	8.625	0.0302	0.12	0.7835
Effluent	EFFLUENT	06-Jan-02	E	8.542	0.0004	0	0.0114
Influent	INFLUENT	05-Jan-02	I	8.592	0	0	0.0008
Influent	INFLUENT	10-Jan-02	I	N/D	N/D	N/D	N/D
Influent	INFLUENT	06-Jan-02	I	8.633	0	0	0.0012
Blank	BLANK	10-Jan-02	B	8.550	0.0006	0.00	0.0162
Blank	BLANK	26-Jan-02	B	N/D	N/D	N/D	N/D
Blank	BLANK	28-Jan-02	B	N/D	N/D	N/D	N/D

### Appendix M: Butyrate, Strata A

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	A	16-Jan-02	1	N/D	N/D	N/D	N/D
1	A	17-Jan-02	1	11.842	0	0	0.0012
1	A	23-Jan-02	1	N/D	N/D	N/D	N/D
2	A	16-Jan-02	1	N/D	N/D	N/D	N/D
2	A	17-Jan-02	1	11.642	0	0	0.0006
2	A	23-Jan-02	1	N/D	N/D	N/D	N/D
3	A	18-Jan-02	1	N/D	N/D	N/D	N/D
3	A	16-Jan-02	1	11.642	0.0005	0	0.0392
3	A	17-Jan-02	1	N/D	N/D	N/D	N/D
4	A	18-Jan-02	2	N/D	N/D	N/D	N/D
4	A	16-Jan-02	2	N/D	N/D	N/D	N/D
4	A	17-Jan-02	2	N/D	N/D	N/D	N/D
5	A	18-Jan-02	2	N/D	N/D	N/D	N/D
5	A	16-Jan-02	2	N/D	N/D	N/D	N/D
5	A	17-Jan-02	2	N/D	N/D	N/D	N/D
6	A	18-Jan-02	2	N/D	N/D	N/D	N/D
6	A	16-Jan-02	2	N/D	N/D	N/D	N/D
6	A	17-Jan-02	2	N/D	N/D	N/D	N/D
7	A	17-Jan-02	1	N/D	N/D	N/D	N/D
7	A	23-Jan-02	1	N/D	N/D	N/D	N/D
8	A	18-Jan-02	1	N/D	N/D	N/D	N/D
8	A	16-Jan-02	1	N/D	N/D	N/D	N/D
8	A	17-Jan-02	1	N/D	N/D	N/D	N/D
9	A	18-Jan-02	1	N/D	N/D	N/D	N/D
9	A	16-Jan-02	1	N/D	N/D	N/D	N/D
9	A	17-Jan-02	1	N/D	N/D	N/D	N/D
10	A	18-Jan-02	2	N/D	N/D	N/D	N/D
10	A	10-Jan-02	2	N/D	N/D	N/D	N/D
10	A	16-Jan-02	2	N/D	N/D	N/D	N/D
10	A	14-Jan-02	2	N/D	N/D	N/D	N/D
11	A	18-Jan-02	2	N/D	N/D	N/D	N/D
11*	A	10-Jan-02	2	12.042	0.0325	0.06	2.3572
11	A	16-Jan-02	2	11.767	0	0	0.0016
11	A	14-Jan-02	2	N/D	N/D	N/D	N/D
12	A	18-Jan-02	2	N/D	N/D	N/D	N/D
12	A	10-Jan-02	2	N/D	N/D	N/D	N/D
12	A	16-Jan-02	2	N/D	N/D	N/D	N/D
13	A	18-Jan-02	3	11.642	0.0004	0	0.0309
13	A	16-Jan-02	3	11.633	0.0036	0.01	0.2579
13	A	17-Jan-02	3	11.625	0.0044	0.02	0.3194
14	A	18-Jan-02	3	N/D	N/D	N/D	N/D
14	A	23-Jan-02	3	N/D	N/D	N/D	N/D
14	A	14-Jan-02	3	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
15	A	18-Jan-02	3	N/D	N/D	N/D	N/D
15	A	17-Jan-02	3	N/D	N/D	N/D	N/D
15	A	23-Jan-02	3	N/D	N/D	N/D	N/D
16	A	18-Jan-02	4	N/D	N/D	N/D	N/D
16	A	10-Jan-02	4	N/D	N/D	N/D	N/D
16	A	23-Jan-02	4	N/D	N/D	N/D	N/D
17	A	17-Jan-02	4	N/D	N/D	N/D	N/D
17	A	18-Jan-02	4	N/D	N/D	N/D	N/D
17	A	23-Jan-02	4	N/D	N/D	N/D	N/D
18	A	18-Jan-02	4	N/D	N/D	N/D	N/D
18	A	23-Jan-02	4	N/D	N/D	N/D	N/D
18	A	14-Jan-02	4	N/D	N/D	N/D	N/D
19	A	17-Jan-02	3	11.625	0.0032	0.01	0.2287
19	A	18-Jan-02	3	11.658	0.0008	0	0.0562
19	A	24-Jan-02	3	11.642	0.0001	0	0.01
20	A	10-Jan-02	3	N/D	N/D	N/D	N/D
20	A	18-Jan-02	3	N/D	N/D	N/D	N/D
20	A	23-Jan-02	3	N/D	N/D	N/D	N/D
21	A	10-Jan-02	3	N/D	N/D	N/D	N/D
21	A	18-Jan-02	3	N/D	N/D	N/D	N/D
21	A	23-Jan-02	3	11.8	0.0018	0.01	0.1325
22	A	10-Jan-02	4	N/D	N/D	N/D	N/D
22	A	18-Jan-02	4	N/D	N/D	N/D	N/D
22	A	23-Jan-02	4	11.55	0	0	0.0009
23	A	10-Jan-02	4	N/D	N/D	N/D	N/D
23	A	18-Jan-02	4	N/D	N/D	N/D	N/D
23	A	14-Jan-02	4	N/D	N/D	N/D	N/D
24	A	10-Jan-02	4	11.658	0	0	0.0025
24	A	18-Jan-02	4	N/D	N/D	N/D	N/D
24	A	14-Jan-02	4	N/D	N/D	N/D	N/D
25	A	10-Jan-02	5	N/D	N/D	N/D	N/D
25	A	18-Jan-02	5	N/D	N/D	N/D	N/D
25	A	23-Jan-02	5	N/D	N/D	N/D	N/D
26	A	17-Jan-02	5	N/D	N/D	N/D	N/D
26	A	18-Jan-02	5	11.742	0.0047	0.01	0.3414
26	A	23-Jan-02	5	N/D	N/D	N/D	N/D
27	A	18-Jan-02	5	N/D	N/D	N/D	N/D
27	A	23-Jan-02	5	N/D	N/D	N/D	N/D
27	A	14-Jan-02	5	N/D	N/D	N/D	N/D
28	A	10-Jan-02	6	N/D	N/D	N/D	N/D
28	A	18-Jan-02	6	N/D	N/D	N/D	N/D
28	A	23-Jan-02	6	N/D	N/D	N/D	N/D
29	A	10-Jan-02	6	N/D	N/D	N/D	N/D
29	A	18-Jan-02	6	N/D	N/D	N/D	N/D



Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
29	A	23-Jan-02	6	11.725	0	0	0.0017
30	A	10-Jan-02	6	N/D	N/D	N/D	N/D
30	A	18-Jan-02	6	N/D	N/D	N/D	N/D
30	A	24-Jan-02	6	N/D	N/D	N/D	N/D
31	A	10-Jan-02	5	N/D	N/D	N/D	N/D
31	A	18-Jan-02	5	N/D	N/D	N/D	N/D
31	A	14-Jan-02	5	N/D	N/D	N/D	N/D
32	A	17-Jan-02	5	11.967	0.0001	0.01	0.0089
32	A	18-Jan-02	5	N/D	N/D	N/D	N/D
32	A	23-Jan-02	5	N/D	N/D	N/D	N/D
33	A	18-Jan-02	5	N/D	N/D	N/D	N/D
33	A	23-Jan-02	5	N/D	N/D	N/D	N/D
33	A	14-Jan-02	5	11.65	0	0	0.0023
34	A	22-Jan-02	8	N/D	N/D	N/D	N/D
34	A	10-Jan-02	8	N/D	N/D	N/D	N/D
34	A	24-Jan-02	8	N/D	N/D	N/D	N/D
35	A	22-Jan-02	8	N/D	N/D	N/D	N/D
35	A	10-Jan-02	8	N/D	N/D	N/D	N/D
35	A	24-Jan-02	8	N/D	N/D	N/D	N/D
36	A	17-Jan-02	8	N/D	N/D	N/D	N/D
36	A	22-Jan-02	8	N/D	N/D	N/D	N/D
36	A	24-Jan-02	8	N/D	N/D	N/D	N/D
37	A	22-Jan-02	7	N/D	N/D	N/D	N/D
37	A	10-Jan-02	7	11.833	0	0	0.0015
37	A	24-Jan-02	7	N/D	N/D	N/D	N/D
38	A	22-Jan-02	7	N/D	N/D	N/D	N/D
38	A	10-Jan-02	7	N/D	N/D	N/D	N/D
38	A	24-Jan-02	7	N/D	N/D	N/D	N/D
39	A	17-Jan-02	7	N/D	N/D	N/D	N/D
39	A	22-Jan-02	7	N/D	N/D	N/D	N/D
39	A	24-Jan-02	7	N/D	N/D	N/D	N/D
40	A	17-Jan-02	8	N/D	N/D	N/D	N/D
40	A	22-Jan-02	8	N/D	N/D	N/D	N/D
40	A	24-Jan-02	8	N/D	N/D	N/D	N/D
41	A	22-Jan-02	8	N/D	N/D	N/D	N/D
41	A	10-Jan-02	8	11.767	0	0	0.001
41	A	24-Jan-02	8	N/D	N/D	N/D	N/D
42	A	17-Jan-02	8	N/D	N/D	N/D	N/D
42	A	22-Jan-02	8	N/D	N/D	N/D	N/D
42	A	24-Jan-02	8	11.658	0.0019	0.01	0.137
43	A	22-Jan-02	9	11.667	0	0	0.0007
43	A	10-Jan-02	9	11.492	0.0001	0	0.0072
43	A	14-Jan-02	9	N/D	N/D	N/D	N/D
44	A	22-Jan-02	9	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
44	A	10-Jan-02	9	11.883	0	0	0.0031
44	A	14-Jan-02	9	N/D	N/D	N/D	N/D
45	A	22-Jan-02	9	N/D	N/D	N/D	N/D
45	A	10-Jan-02	9	N/D	N/D	N/D	N/D
45	A	24-Jan-02	9	N/D	N/D	N/D	N/D
46	A	17-Jan-02	10	N/D	N/D	N/D	N/D
46	A	22-Jan-02	10	N/D	N/D	N/D	N/D
46	A	24-Jan-02	10	N/D	N/D	N/D	N/D
47	A	17-Jan-02	10	11.658	0.0002	0	0.0111
47	A	22-Jan-02	10	11.633	0.0004	0	0.0255
47	A	24-Jan-02	10	N/D	N/D	N/D	N/D
48	A	22-Jan-02	10	N/D	N/D	N/D	N/D
48	A	10-Jan-02	10	N/D	N/D	N/D	N/D
48	A	14-Jan-02	10	N/D	N/D	N/D	N/D
49	A	22-Jan-02	11	N/D	N/D	N/D	N/D
49	A	10-Jan-02	11	N/D	N/D	N/D	N/D
49	A	24-Jan-02	11	N/D	N/D	N/D	N/D
50	A	22-Jan-02	11	N/D	N/D	N/D	N/D
50	A	10-Jan-02	11	N/D	N/D	N/D	N/D
50	A	24-Jan-02	11	N/D	N/D	N/D	N/D
51	A	22-Jan-02	11	N/D	N/D	N/D	N/D
51	A	10-Jan-02	11	N/D	N/D	N/D	N/D
51	A	24-Jan-02	11	N/D	N/D	N/D	N/D
52	A	17-Jan-02	12	N/D	N/D	N/D	N/D
52	A	22-Jan-02	12	N/D	N/D	N/D	N/D
52	A	24-Jan-02	12	N/D	N/D	N/D	N/D
53	A	17-Jan-02	12	N/D	N/D	N/D	N/D
53	A	22-Jan-02	12	N/D	N/D	N/D	N/D
53	A	24-Jan-02	12	N/D	N/D	N/D	N/D
54	A	22-Jan-02	12	N/D	N/D	N/D	N/D
54	A	10-Jan-02	12	N/D	N/D	N/D	N/D
54	A	24-Jan-02	12	N/D	N/D	N/D	N/D
55	A	22-Jan-02	13	N/D	N/D	N/D	N/D
55	A	10-Jan-02	13	N/D	N/D	N/D	N/D
55	A	24-Jan-02	13	N/D	N/D	N/D	N/D
56	A	17-Jan-02	13	N/D	N/D	N/D	N/D
56	A	22-Jan-02	13	N/D	N/D	N/D	N/D
56	A	24-Jan-02	13	N/D	N/D	N/D	N/D
57	A	22-Jan-02	13	N/D	N/D	N/D	N/D
57	A	10-Jan-02	13	N/D	N/D	N/D	N/D
57	A	24-Jan-02	13	N/D	N/D	N/D	N/D
58	A	22-Jan-02	12	N/D	N/D	N/D	N/D
58	A	10-Jan-02	12	N/D	N/D	N/D	N/D
58	A	24-Jan-02	12	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
59	A	22-Jan-02	12	N/D	N/D	N/D	N/D
59	A	10-Jan-02	12	N/D	N/D	N/D	N/D
59	A	24-Jan-02	12	N/D	N/D	N/D	N/D
60	A	22-Jan-02	12	N/D	N/D	N/D	N/D
60	A	10-Jan-02	12	11.65	0	0	0.001
60	A	14-Jan-02	12	N/D	N/D	N/D	N/D
61	A	22-Jan-02	13	N/D	N/D	N/D	N/D
61	A	10-Jan-02	13	N/D	N/D	N/D	N/D
61	A	14-Jan-02	13	N/D	N/D	N/D	N/D
62	A	22-Jan-02	13	11.633	0.0004	0	0.0326
62	A	10-Jan-02	13	11.617	0.0046	0.02	0.3304
62	A	24-Jan-02	13	N/D	N/D	N/D	N/D
63	A	22-Jan-02	13	11.65	0.0002	0	0.0143
63	A	10-Jan-02	13	11.625	0.0048	0.02	0.3498
63	A	14-Jan-02	13	11.633	0.0005	0	0.036
64	A	22-Jan-02	14	N/D	N/D	N/D	N/D
64	A	10-Jan-02	14	N/D	N/D	N/D	N/D
64	A	24-Jan-02	14	N/D	N/D	N/D	N/D
65	A	17-Jan-02	14	N/D	N/D	N/D	N/D
65	A	22-Jan-02	14	N/D	N/D	N/D	N/D
65	A	24-Jan-02	14	N/D	N/D	N/D	N/D
66	A	17-Jan-02	14	N/D	N/D	N/D	N/D
66	A	23-Jan-02	14	11.767	0	0	0.0009
66	A	24-Jan-02	14	N/D	N/D	N/D	N/D

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix N: Butyrate, Strata B

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	B	25-Jan-02	1	11.708	0.0108	0.07	0.3325
1	B	17-Jan-02	1	11.642	0.0069	0.03	0.2112
1	B	15-Jan-02	1	11.708	0.0136	0.05	0.4203
2	B	25-Jan-02	1	11.775	0	0	0.0003
2	B	13-Jan-02	1	N/D	N/D	N/D	N/D
2	B	15-Jan-02	1	N/D	N/D	N/D	N/D
3	B	25-Jan-02	1	11.5	0.0001	0	0.0033
3	B	13-Jan-02	1	N/D	N/D	N/D	N/D
3	B	15-Jan-02	1	N/D	N/D	N/D	N/D
4	B	25-Jan-02	2	N/D	N/D	N/D	N/D
4	B	13-Jan-02	2	N/D	N/D	N/D	N/D
4	B	15-Jan-02	2	11.883	0.0046	0.01	0.1428
5	B	25-Jan-02	2	N/D	N/D	N/D	N/D
5	B	17-Jan-02	2	N/D	N/D	N/D	N/D
5	B	15-Jan-02	2	N/D	N/D	N/D	N/D
6	B	25-Jan-02	2	N/D	N/D	N/D	N/D
6	B	13-Jan-02	2	N/D	N/D	N/D	N/D
6	B	15-Jan-02	2	N/D	N/D	N/D	N/D
7	B	25-Jan-02	1	N/D	N/D	N/D	N/D
7	B	17-Jan-02	1	N/D	N/D	N/D	N/D
7	B	15-Jan-02	1	N/D	N/D	N/D	N/D
8	B	25-Jan-02	1	N/D	N/D	N/D	N/D
8	B	13-Jan-02	1	N/D	N/D	N/D	N/D
8	B	15-Jan-02	1	N/D	N/D	N/D	N/D
9	B	25-Jan-02	1	N/D	N/D	N/D	N/D
9	B	13-Jan-02	1	N/D	N/D	N/D	N/D
9	B	15-Jan-02	1	N/D	N/D	N/D	N/D
10	B	25-Jan-02	2	N/D	N/D	N/D	N/D
10	B	13-Jan-02	2	N/D	N/D	N/D	N/D
10	B	15-Jan-02	2	N/D	N/D	N/D	N/D
11	B	25-Jan-02	2	N/D	N/D	N/D	N/D
11	B	13-Jan-02	2	N/D	N/D	N/D	N/D
11	B	15-Jan-02	2	N/D	N/D	N/D	N/D
12	B	25-Jan-02	2	11.908	0	0	0.0008
12	B	13-Jan-02	2	N/D	N/D	N/D	N/D
12	B	15-Jan-02	2	N/D	N/D	N/D	N/D
13	B	17-Jan-02	3	N/D	N/D	N/D	N/D
14	B	25-Jan-02	3	N/D	N/D	N/D	N/D
14	B	13-Jan-02	3	11.667	0.0005	0	0.0143
14	B	15-Jan-02	3	N/D	N/D	N/D	N/D
15	B	25-Jan-02	3	N/D	N/D	N/D	N/D
15	B	13-Jan-02	3	N/D	N/D	N/D	N/D
15	B	15-Jan-02	3	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
16	B	25-Jan-02	4	N/D	N/D	N/D	N/D
16	B	13-Jan-02	4	N/D	N/D	N/D	N/D
16	B	15-Jan-02	4	N/D	N/D	N/D	N/D
17	B	25-Jan-02	4	N/D	N/D	N/D	N/D
17	B	17-Jan-02	4	N/D	N/D	N/D	N/D
17	B	15-Jan-02	4	N/D	N/D	N/D	N/D
18	B	25-Jan-02	4	N/D	N/D	N/D	N/D
18	B	17-Jan-02	4	N/D	N/D	N/D	N/D
18	B	15-Jan-02	4	N/D	N/D	N/D	N/D
19	B	25-Jan-02	3	N/D	N/D	N/D	N/D
19	B	17-Jan-02	3	N/D	N/D	N/D	N/D
19	B	16-Jan-02	3	11.708	0	0	0.0002
20	B	25-Jan-02	3	N/D	N/D	N/D	N/D
20	B	13-Jan-02	3	N/D	N/D	N/D	N/D
20	B	15-Jan-02	3	N/D	N/D	N/D	N/D
21	B	25-Jan-02	3	N/D	N/D	N/D	N/D
21	B	13-Jan-02	3	N/D	N/D	N/D	N/D
21	B	15-Jan-02	3	N/D	N/D	N/D	N/D
22	B	25-Jan-02	4	N/D	N/D	N/D	N/D
22	B	13-Jan-02	4	N/D	N/D	N/D	N/D
22	B	15-Jan-02	4	N/D	N/D	N/D	N/D
23	B	25-Jan-02	4	N/D	N/D	N/D	N/D
23	B	13-Jan-02	4	N/D	N/D	N/D	N/D
23	B	15-Jan-02	4	N/D	N/D	N/D	N/D
24	B	25-Jan-02	4	N/D	N/D	N/D	N/D
24	B	13-Jan-02	4	N/D	N/D	N/D	N/D
24	B	15-Jan-02	4	N/D	N/D	N/D	N/D
25	B	25-Jan-02	5	N/D	N/D	N/D	N/D
25	B	13-Jan-02	5	N/D	N/D	N/D	N/D
25	B	15-Jan-02	5	N/D	N/D	N/D	N/D
26	B	25-Jan-02	5	N/D	N/D	N/D	N/D
26	B	13-Jan-02	5	11.742	0.0002	0.01	0.0067
26	B	15-Jan-02	5	N/D	N/D	N/D	N/D
27	B	25-Jan-02	5	N/D	N/D	N/D	N/D
27	B	13-Jan-02	5	N/D	N/D	N/D	N/D
27	B	15-Jan-02	5	N/D	N/D	N/D	N/D
28	B	25-Jan-02	6	N/D	N/D	N/D	N/D
28	B	13-Jan-02	6	N/D	N/D	N/D	N/D
28	B	15-Jan-02	6	N/D	N/D	N/D	N/D
29	B	25-Jan-02	6	N/D	N/D	N/D	N/D
29	B	13-Jan-02	6	N/D	N/D	N/D	N/D
29	B	15-Jan-02	6	N/D	N/D	N/D	N/D
30	B	25-Jan-02	6	N/D	N/D	N/D	N/D
30	B	13-Jan-02	6	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
30	B	15-Jan-02	6	N/D	N/D	N/D	N/D
31	B	25-Jan-02	5	11.6	0.0045	0.02	0.1378
31	B	13-Jan-02	5	11.65	0.0103	0.03	0.318
31	B	15-Jan-02	5	11.642	0.0027	0.02	0.0825
32	B	13-Jan-02	5	N/D	N/D	N/D	N/D
32	B	15-Jan-02	5	N/D	N/D	N/D	N/D
32	B	16-Jan-02	5	N/D	N/D	N/D	N/D
33	B	25-Jan-02	5	N/D	N/D	N/D	N/D
33	B	13-Jan-02	5	N/D	N/D	N/D	N/D
33	B	15-Jan-02	5	N/D	N/D	N/D	N/D
34	B	16-Jan-02	8	11.675	0	0	0.0003
34	B	26-Jan-02	8	N/D	N/D	N/D	N/D
34	B	13-Jan-02	8	N/D	N/D	N/D	N/D
35	B	16-Jan-02	8	N/D	N/D	N/D	N/D
35	B	26-Jan-02	8	N/D	N/D	N/D	N/D
35	B	13-Jan-02	8	N/D	N/D	N/D	N/D
36	B	16-Jan-02	8	N/D	N/D	N/D	N/D
36	B	26-Jan-02	8	N/D	N/D	N/D	N/D
36	B	13-Jan-02	8	N/D	N/D	N/D	N/D
37	B	26-Jan-02	7	11.442	0	0	0.0004
37	B	13-Jan-02	7	N/D	N/D	N/D	N/D
37	B	23-Jan-02	7	N/D	N/D	N/D	N/D
38	B	16-Jan-02	7	N/D	N/D	N/D	N/D
38	B	26-Jan-02	7	N/D	N/D	N/D	N/D
38	B	13-Jan-02	7	N/D	N/D	N/D	N/D
39	B	16-Jan-02	7	N/D	N/D	N/D	N/D
39	B	26-Jan-02	7	N/D	N/D	N/D	N/D
39	B	13-Jan-02	7	N/D	N/D	N/D	N/D
40	B	16-Jan-02	8	N/D	N/D	N/D	N/D
40	B	26-Jan-02	8	N/D	N/D	N/D	N/D
40	B	13-Jan-02	8	N/D	N/D	N/D	N/D
41	B	16-Jan-02	8	N/D	N/D	N/D	N/D
41	B	26-Jan-02	8	N/D	N/D	N/D	N/D
41	B	13-Jan-02	8	N/D	N/D	N/D	N/D
42	B	16-Jan-02	8	N/D	N/D	N/D	N/D
42	B	26-Jan-02	8	N/D	N/D	N/D	N/D
42	B	13-Jan-02	8	N/D	N/D	N/D	N/D
43	B	16-Jan-02	9	N/D	N/D	N/D	N/D
43	B	26-Jan-02	9	N/D	N/D	N/D	N/D
43	B	13-Jan-02	9	N/D	N/D	N/D	N/D
44	B	16-Jan-02	9	N/D	N/D	N/D	N/D
44	B	26-Jan-02	9	N/D	N/D	N/D	N/D
44	B	13-Jan-02	9	N/D	N/D	N/D	N/D
45	B	16-Jan-02	9	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
45	B	26-Jan-02	9	11.633	0.0004	0	0.012
45	B	13-Jan-02	9	N/D	N/D	N/D	N/D
46	B	16-Jan-02	10	N/D	N/D	N/D	N/D
46	B	26-Jan-02	10	N/D	N/D	N/D	N/D
46	B	13-Jan-02	10	N/D	N/D	N/D	N/D
47	B	16-Jan-02	10	N/D	N/D	N/D	N/D
47	B	26-Jan-02	10	N/D	N/D	N/D	N/D
47	B	13-Jan-02	10	N/D	N/D	N/D	N/D
48	B	15-Jan-02	10	N/D	N/D	N/D	N/D
48	B	16-Jan-02	10	N/D	N/D	N/D	N/D
48	B	13-Jan-02	10	N/D	N/D	N/D	N/D
49	B	16-Jan-02	11	N/D	N/D	N/D	N/D
49	B	26-Jan-02	11	N/D	N/D	N/D	N/D
49	B	13-Jan-02	11	N/D	N/D	N/D	N/D
50	B	26-Jan-02	11	N/D	N/D	N/D	N/D
50	B	13-Jan-02	11	N/D	N/D	N/D	N/D
50	B	23-Jan-02	11	11.592	0.0003	0	0.0079
51	B	16-Jan-02	11	N/D	N/D	N/D	N/D
51	B	26-Jan-02	11	N/D	N/D	N/D	N/D
51	B	13-Jan-02	11	N/D	N/D	N/D	N/D
52	B	16-Jan-02	12	N/D	N/D	N/D	N/D
52	B	26-Jan-02	12	N/D	N/D	N/D	N/D
52	B	13-Jan-02	12	N/D	N/D	N/D	N/D
53	B	16-Jan-02	12	N/D	N/D	N/D	N/D
53	B	26-Jan-02	12	N/D	N/D	N/D	N/D
53	B	13-Jan-02	12	N/D	N/D	N/D	N/D
54	B	16-Jan-02	12	N/D	N/D	N/D	N/D
54	B	26-Jan-02	12	N/D	N/D	N/D	N/D
54	B	13-Jan-02	12	N/D	N/D	N/D	N/D
55	B	16-Jan-02	13	N/D	N/D	N/D	N/D
55	B	26-Jan-02	13	N/D	N/D	N/D	N/D
55	B	13-Jan-02	13	N/D	N/D	N/D	N/D
56	B	15-Jan-02	13	N/D	N/D	N/D	N/D
56	B	16-Jan-02	13	N/D	N/D	N/D	N/D
57	B	16-Jan-02	13	N/D	N/D	N/D	N/D
57	B	26-Jan-02	13	N/D	N/D	N/D	N/D
57	B	13-Jan-02	13	N/D	N/D	N/D	N/D
58	B	16-Jan-02	12	N/D	N/D	N/D	N/D
58	B	26-Jan-02	12	N/D	N/D	N/D	N/D
58	B	13-Jan-02	12	N/D	N/D	N/D	N/D
59	B	16-Jan-02	12	N/D	N/D	N/D	N/D
59	B	26-Jan-02	12	N/D	N/D	N/D	N/D
59	B	13-Jan-02	12	N/D	N/D	N/D	N/D
60	B	16-Jan-02	12	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
60	B	26-Jan-02	12	N/D	N/D	N/D	N/D
60	B	13-Jan-02	12	N/D	N/D	N/D	N/D
61	B	16-Jan-02	13	N/D	N/D	N/D	N/D
61	B	26-Jan-02	13	N/D	N/D	N/D	N/D
61	B	13-Jan-02	13	N/D	N/D	N/D	N/D
62	B	16-Jan-02	13	N/D	N/D	N/D	N/D
62	B	26-Jan-02	13	N/D	N/D	N/D	N/D
62	B	13-Jan-02	13	N/D	N/D	N/D	N/D
63	B	16-Jan-02	13	N/D	N/D	N/D	N/D
63	B	26-Jan-02	13	N/D	N/D	N/D	N/D
63	B	13-Jan-02	13	N/D	N/D	N/D	N/D
64	B	16-Jan-02	14	N/D	N/D	N/D	N/D
64	B	26-Jan-02	14	N/D	N/D	N/D	N/D
64	B	13-Jan-02	14	11.625	0.0065	0.05	0.199
65	B	16-Jan-02	14	N/D	N/D	N/D	N/D
65	B	26-Jan-02	14	N/D	N/D	N/D	N/D
65	B	13-Jan-02	14	N/D	N/D	N/D	N/D
66	B	16-Jan-02	14	N/D	N/D	N/D	N/D
66	B	26-Jan-02	14	N/D	N/D	N/D	N/D
66	B	13-Jan-02	14	N/D	N/D	N/D	N/D

\*—JMP 4.0 Outlier

N/D—Not Detected



### Appendix O: Butyrate, Strata C

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	C	16-Jan-02	1	N/D	N/D	N/D	N/D
1	C	17-Jan-02	1	N/D	N/D	N/D	N/D
1	C	26-Jan-02	1	N/D	N/D	N/D	N/D
2	C	16-Jan-02	1	N/D	N/D	N/D	N/D
2	C	17-Jan-02	1	N/D	N/D	N/D	N/D
2	C	26-Jan-02	1	N/D	N/D	N/D	N/D
3	C	16-Jan-02	1	N/D	N/D	N/D	N/D
3	C	17-Jan-02	1	N/D	N/D	N/D	N/D
3	C	26-Jan-02	1	N/D	N/D	N/D	N/D
4	C	16-Jan-02	2	N/D	N/D	N/D	N/D
4	C	17-Jan-02	2	N/D	N/D	N/D	N/D
4	C	26-Jan-02	2	N/D	N/D	N/D	N/D
5	C	16-Jan-02	2	N/D	N/D	N/D	N/D
5	C	17-Jan-02	2	N/D	N/D	N/D	N/D
5	C	26-Jan-02	2	N/D	N/D	N/D	N/D
7	C	16-Jan-02	1	N/D	N/D	N/D	N/D
7	C	26-Jan-02	1	11.6	0.0001	0	0.0021
7	C	22-Jan-02	1	N/D	N/D	N/D	N/D
8	C	26-Jan-02	1	11.683	0	0	0.0006
8	C	23-Jan-02	1	N/D	N/D	N/D	N/D
8	C	22-Jan-02	1	N/D	N/D	N/D	N/D
9	C	16-Jan-02	1	N/D	N/D	N/D	N/D
9	C	26-Jan-02	1	N/D	N/D	N/D	N/D
9	C	22-Jan-02	1	N/D	N/D	N/D	N/D
10	C	16-Jan-02	2	N/D	N/D	N/D	N/D
10	C	26-Jan-02	2	N/D	N/D	N/D	N/D
10	C	6-Jan-02	2	N/D	N/D	N/D	N/D
11	C	16-Jan-02	2	N/D	N/D	N/D	N/D
11	C	26-Jan-02	2	N/D	N/D	N/D	N/D
11	C	6-Jan-02	2	N/D	N/D	N/D	N/D
12	C	16-Jan-02	2	N/D	N/D	N/D	N/D
12	C	26-Jan-02	2	N/D	N/D	N/D	N/D
12	C	23-Jan-02	2	N/D	N/D	N/D	N/D
13	C	16-Jan-02	3	N/D	N/D	N/D	N/D
13	C	10-Jan-02	3	N/D	N/D	N/D	N/D
13	C	26-Jan-02	3	N/D	N/D	N/D	N/D
14	C	10-Jan-02	3	N/D	N/D	N/D	N/D
14	C	26-Jan-02	3	N/D	N/D	N/D	N/D
14	C	23-Jan-02	3	N/D	N/D	N/D	N/D
15	C	10-Jan-02	3	N/D	N/D	N/D	N/D
15	C	26-Jan-02	3	N/D	N/D	N/D	N/D
15	C	23-Jan-02	3	N/D	N/D	N/D	N/D
16	C	10-Jan-02	4	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
16	C	26-Jan-02	4	N/D	N/D	N/D	N/D
16	C	6-Jan-02	4	N/D	N/D	N/D	N/D
17	C	10-Jan-02	4	N/D	N/D	N/D	N/D
17	C	26-Jan-02	4	N/D	N/D	N/D	N/D
17	C	23-Jan-02	4	N/D	N/D	N/D	N/D
18	C	10-Jan-02	4	N/D	N/D	N/D	N/D
18	C	26-Jan-02	4	N/D	N/D	N/D	N/D
18	C	23-Jan-02	4	N/D	N/D	N/D	N/D
19	C	16-Jan-02	3	N/D	N/D	N/D	N/D
19	C	10-Jan-02	3	N/D	N/D	N/D	N/D
20	C	16-Jan-02	3	N/D	N/D	N/D	N/D
20	C	10-Jan-02	3	N/D	N/D	N/D	N/D
20	C	26-Jan-02	3	11.683	0	0	0.0008
21	C	10-Jan-02	3	N/D	N/D	N/D	N/D
21	C	26-Jan-02	3	11.675	0.0009	0	0.0273
21	C	6-Jan-02	3	N/D	N/D	N/D	N/D
22	C	5-Jan-02	4	N/D	N/D	N/D	N/D
22	C	10-Jan-02	4	N/D	N/D	N/D	N/D
22	C	6-Jan-02	4	N/D	N/D	N/D	N/D
23	C	5-Jan-02	4	N/D	N/D	N/D	N/D
23	C	10-Jan-02	4	N/D	N/D	N/D	N/D
23	C	6-Jan-02	4	11.783	0	0	0.0012
24	C	5-Jan-02	4	N/D	N/D	N/D	N/D
24	C	10-Jan-02	4	N/D	N/D	N/D	N/D
24	C	6-Jan-02	4	N/D	N/D	N/D	N/D
25	C	5-Jan-02	5	N/D	N/D	N/D	N/D
25	C	10-Jan-02	5	N/D	N/D	N/D	N/D
25	C	28-Jan-02	5	N/D	N/D	N/D	N/D
26	C	10-Jan-02	5	N/D	N/D	N/D	N/D
26	C	28-Jan-02	5	N/D	N/D	N/D	N/D
26	C	23-Jan-02	5	N/D	N/D	N/D	N/D
27	C	10-Jan-02	5	11.675	0.0003	0	0.0091
27	C	28-Jan-02	5	N/D	N/D	N/D	N/D
27	C	23-Jan-02	5	N/D	N/D	N/D	N/D
28	C	5-Jan-02	6	N/D	N/D	N/D	N/D
28*	C	10-Jan-02	6	11.792	0.0239	0.05	0.7377
28	C	6-Jan-02	6	11.583	0.0001	0	0.0017
29	C	5-Jan-02	6	N/D	N/D	N/D	N/D
29	C	10-Jan-02	6	N/D	N/D	N/D	N/D
29	C	6-Jan-02	6	11.533	0	0	0.0005
30	C	5-Jan-02	6	11.733	0.0001	0	0.0045
30	C	10-Jan-02	6	N/D	N/D	N/D	N/D
30	C	6-Jan-02	6	11.6	0.0002	0	0.0076
31	C	5-Jan-02	5	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
31	C	10-Jan-02	5	N/D	N/D	N/D	N/D
31	C	28-Jan-02	5	11.667	0.0021	0	0.0652
32	C	10-Jan-02	5	N/D	N/D	N/D	N/D
32	C	28-Jan-02	5	N/D	N/D	N/D	N/D
32	C	23-Jan-02	5	N/D	N/D	N/D	N/D
33	C	10-Jan-02	5	N/D	N/D	N/D	N/D
33	C	28-Jan-02	5	N/D	N/D	N/D	N/D
33	C	23-Jan-02	5	N/D	N/D	N/D	N/D
34	C	5-Jan-02	8	N/D	N/D	N/D	N/D
34	C	10-Jan-02	8	N/D	N/D	N/D	N/D
34	C	6-Jan-02	8	N/D	N/D	N/D	N/D
35	C	5-Jan-02	8	11.4	0	0	0.0011
35	C	10-Jan-02	8	N/D	N/D	N/D	N/D
35	C	6-Jan-02	8	N/D	N/D	N/D	N/D
36	C	5-Jan-02	8	N/D	N/D	N/D	N/D
36	C	10-Jan-02	8	N/D	N/D	N/D	N/D
36	C	6-Jan-02	8	N/D	N/D	N/D	N/D
37	C	5-Jan-02	7	N/D	N/D	N/D	N/D
37	C	10-Jan-02	7	N/D	N/D	N/D	N/D
37	C	28-Jan-02	7	N/D	N/D	N/D	N/D
37	C	6-Jan-02	7	11.8	0	0	0.0006
38	C	10-Jan-02	7	N/D	N/D	N/D	N/D
38	C	28-Jan-02	7	12.008	0.0031	0	0.0961
38	C	6-Jan-02	7	N/D	N/D	N/D	N/D
39	C	10-Jan-02	7	N/D	N/D	N/D	N/D
39	C	28-Jan-02	7	N/D	N/D	N/D	N/D
39	C	23-Jan-02	7	N/D	N/D	N/D	N/D
40	C	10-Jan-02	8	N/D	N/D	N/D	N/D
40	C	28-Jan-02	8	N/D	N/D	N/D	N/D
40	C	23-Jan-02	8	N/D	N/D	N/D	N/D
41	C	10-Jan-02	8	N/D	N/D	N/D	N/D
41	C	28-Jan-02	8	N/D	N/D	N/D	N/D
41	C	6-Jan-02	8	N/D	N/D	N/D	N/D
42	C	10-Jan-02	8	N/D	N/D	N/D	N/D
42	C	28-Jan-02	8	11.692	0.0018	0	0.0559
42	C	23-Jan-02	8	N/D	N/D	N/D	N/D
43	C	10-Jan-02	9	N/D	N/D	N/D	N/D
43	C	28-Jan-02	9	N/D	N/D	N/D	N/D
43	C	6-Jan-02	9	N/D	N/D	N/D	N/D
44	C	10-Jan-02	9	N/D	N/D	N/D	N/D
44	C	28-Jan-02	9	N/D	N/D	N/D	N/D
44	C	23-Jan-02	9	N/D	N/D	N/D	N/D
45	C	10-Jan-02	9	N/D	N/D	N/D	N/D
45	C	28-Jan-02	9	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
45	C	23-Jan-02	9	N/D	N/D	N/D	N/D
46	C	28-Jan-02	10	N/D	N/D	N/D	N/D
46	C	10-Jan-02	10	N/D	N/D	N/D	N/D
46	C	23-Jan-02	10	N/D	N/D	N/D	N/D
47	C	28-Jan-02	10	11.925	0	0	0.0008
47	C	10-Jan-02	10	N/D	N/D	N/D	N/D
47	C	23-Jan-02	10	N/D	N/D	N/D	N/D
48	C	28-Jan-02	10	N/D	N/D	N/D	N/D
48	C	10-Jan-02	10	N/D	N/D	N/D	N/D
48	C	6-Jan-02	10	N/D	N/D	N/D	N/D
49	C	28-Jan-02	11	N/D	N/D	N/D	N/D
49	C	10-Jan-02	11	N/D	N/D	N/D	N/D
49	C	6-Jan-02	11	N/D	N/D	N/D	N/D
50	C	28-Jan-02	11	N/D	N/D	N/D	N/D
50	C	10-Jan-02	11	N/D	N/D	N/D	N/D
50	C	6-Jan-02	11	N/D	N/D	N/D	N/D
51	C	28-Jan-02	11	N/D	N/D	N/D	N/D
51	C	10-Jan-02	11	N/D	N/D	N/D	N/D
51	C	6-Jan-02	11	11.9	0.0004	0	0.0132
52	C	28-Jan-02	12	N/D	N/D	N/D	N/D
52	C	10-Jan-02	12	N/D	N/D	N/D	N/D
52	C	23-Jan-02	12	12	0.0028	0.01	0.0861
53	C	28-Jan-02	12	N/D	N/D	N/D	N/D
53	C	10-Jan-02	12	N/D	N/D	N/D	N/D
53	C	23-Jan-02	12	N/D	N/D	N/D	N/D
54	C	28-Jan-02	12	N/D	N/D	N/D	N/D
54	C	10-Jan-02	12	11.617	0	0	0.0015
54	C	23-Jan-02	12	N/D	N/D	N/D	N/D
55	C	28-Jan-02	13	N/D	N/D	N/D	N/D
55	C	10-Jan-02	13	N/D	N/D	N/D	N/D
55	C	23-Jan-02	13	N/D	N/D	N/D	N/D
56	C	28-Jan-02	13	N/D	N/D	N/D	N/D
56	C	10-Jan-02	13	N/D	N/D	N/D	N/D
56	C	23-Jan-02	13	N/D	N/D	N/D	N/D
57	C	28-Jan-02	13	N/D	N/D	N/D	N/D
57	C	10-Jan-02	13	N/D	N/D	N/D	N/D
57	C	23-Jan-02	13	N/D	N/D	N/D	N/D
58	C	28-Jan-02	12	N/D	N/D	N/D	N/D
58*	C	10-Jan-02	12	11.708	0.0246	0.04	0.757
58	C	23-Jan-02	12	N/D	N/D	N/D	N/D
59	C	28-Jan-02	12	N/D	N/D	N/D	N/D
59	C	10-Jan-02	12	N/D	N/D	N/D	N/D
59	C	23-Jan-02	12	N/D	N/D	N/D	N/D
60	C	28-Jan-02	12	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
60	C	10-Jan-02	12	N/D	N/D	N/D	N/D
60	C	6-Jan-02	12	11.65	0	0	0.0006
61	C	28-Jan-02	13	N/D	N/D	N/D	N/D
61	C	10-Jan-02	13	N/D	N/D	N/D	N/D
61	C	23-Jan-02	13	N/D	N/D	N/D	N/D
62	C	28-Jan-02	13	N/D	N/D	N/D	N/D
62	C	10-Jan-02	13	N/D	N/D	N/D	N/D
62	C	23-Jan-02	13	N/D	N/D	N/D	N/D
63	C	28-Jan-02	13	N/D	N/D	N/D	N/D
63	C	10-Jan-02	13	N/D	N/D	N/D	N/D
63	C	23-Jan-02	13	N/D	N/D	N/D	N/D
64	C	28-Jan-02	14	N/D	N/D	N/D	N/D
64	C	10-Jan-02	14	N/D	N/D	N/D	N/D
64	C	23-Jan-02	14	N/D	N/D	N/D	N/D
65	C	28-Jan-02	14	N/D	N/D	N/D	N/D
65	C	10-Jan-02	14	N/D	N/D	N/D	N/D
65	C	23-Jan-02	14	N/D	N/D	N/D	N/D
66	C	28-Jan-02	14	N/D	N/D	N/D	N/D
66	C	10-Jan-02	14	N/D	N/D	N/D	N/D
66	C	23-Jan-02	14	N/D	N/D	N/D	N/D

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix P: Butyrate, Field Blanks, Influent and Effluent

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
Blank	BLANK	10-Jan-02	B	N/D	N/D	N/D	N/D
Blank	BLANK	26-Jan-02	B	N/D	N/D	N/D	N/D
Blank	BLANK	28-Jan-02	B	N/D	N/D	N/D	N/D
Influent	INFLUENT	5-Jan-02	I	N/D	N/D	N/D	N/D
Influent	INFLUENT	10-Jan-02	I	N/D	N/D	N/D	N/D
Influent	INFLUENT	6-Jan-02	I	11.408	0	0	0.0007
Effluent	EFFLUENT	5-Jan-02	E	N/D	N/D	N/D	N/D
Effluent	EFFLUENT	10-Jan-02	E	11.725	0.0005	0	0.0242
Effluent	EFFLUENT	6-Jan-02	E	11.642	0	0	0.0014

### Appendix Q: Chloride, Strata A

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	A	16-Jan-02	1	15.517	5.1646	37.88	75.7562
1	A	17-Jan-02	1	15.5	5.3676	39.14	78.7329
1	A	23-Jan-02	1	15.508	5.3203	38.97	78.04
2	A	16-Jan-02	1	15.5	4.9883	36.44	73.1696
2	A	17-Jan-02	1	15.492	5.2782	38.5	77.4221
2	A	23-Jan-02	1	15.492	5.2763	38.69	77.3938
3	A	18-Jan-02	1	15.475	3.9219	28.66	57.5269
3	A	16-Jan-02	1	15.483	3.8134	27.77	55.9362
3	A	17-Jan-02	1	15.475	4.7928	34.77	70.3015
4	A	18-Jan-02	2	15.5	5.9419	43.18	87.1573
4	A	16-Jan-02	2	15.492	5.6159	40.93	82.375
4	A	17-Jan-02	2	15.483	5.6096	40.87	82.283
5	A	18-Jan-02	2	15.475	3.7532	27.47	55.0522
5	A	16-Jan-02	2	15.483	3.7949	27.71	55.6648
5	A	17-Jan-02	2	15.475	3.6803	26.91	53.9836
6	A	18-Jan-02	2	15.508	9.3037	66.05	136.4695
6	A	16-Jan-02	2	15.525	9.608	67.84	140.9317
6	A	17-Jan-02	2	15.517	10.481	73.23	153.7378
7	A	17-Jan-02	1	15.483	4.2875	31.44	62.8896
7	A	23-Jan-02	1	15.492	5.2367	38.23	76.8128
8	A	18-Jan-02	1	15.475	4.2415	30.92	62.2147
8	A	16-Jan-02	1	15.492	4.3235	31.39	63.4174
8	A	17-Jan-02	1	15.475	4.3008	31.48	63.0856
9	A	18-Jan-02	1	15.483	5.0141	36.7	73.5481
9	A	16-Jan-02	1	15.483	4.5783	33.52	67.1552
9	A	17-Jan-02	1	15.483	4.7089	34.45	69.0711
10	A	18-Jan-02	2	15.5	5.4418	39.81	79.8223
10	A	10-Jan-02	2	15.4	4.979	36.16	73.033
10	A	16-Jan-02	2	15.5	5.6424	41.21	82.7641
10	A	14-Jan-02	2	15.525	3.9765	29.41	58.328
11	A	18-Jan-02	2	15.475	3.5786	26.17	52.4924
11	A	10-Jan-02	2	15.467	3.4775	25.33	51.0089
11	A	16-Jan-02	2	15.483	3.4753	25.41	50.9765
11	A	14-Jan-02	2	15.508	3.8407	28.12	56.3364
12	A	18-Jan-02	2	15.467	3.9169	28.61	57.4542
12	A	10-Jan-02	2	15.508	3.6235	26.35	53.1505
12	A	16-Jan-02	2	15.475	3.8487	28.06	56.453
13	A	18-Jan-02	3	15.492	6.4578	46.84	94.7244
13	A	16-Jan-02	3	15.5	6.4251	46.51	94.2449
13	A	17-Jan-02	3	15.492	6.8394	49.48	100.3216
14	A	18-Jan-02	3	15.475	4.6593	34.03	68.3436
14	A	23-Jan-02	3	15.467	4.7695	34.76	69.9596
14	A	14-Jan-02	3	15.508	4.248	31.14	62.3111

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
15	A	18-Jan-02	3	15.492	6.5021	47.05	95.3743
15	A	17-Jan-02	3	15.483	5.1459	37.61	75.4813
15	A	23-Jan-02	3	15.475	4.8943	35.79	71.7905
16	A	18-Jan-02	4	15.492	5.4482	39.76	79.9155
16	A	10-Jan-02	4	15.542	5.375	39.3	78.8419
16	A	23-Jan-02	4	15.483	5.6895	41.5	83.4555
17	A	17-Jan-02	4	15.467	3.1308	22.9	45.9229
17	A	18-Jan-02	4	15.508	3.1772	23.37	46.6034
17	A	23-Jan-02	4	15.458	3.0877	22.65	45.2916
18	A	18-Jan-02	4	15.525	6.8745	49.57	100.8364
18	A	23-Jan-02	4	15.483	6.4348	46.59	94.387
18	A	14-Jan-02	4	15.508	3.633	26.84	53.2893
19	A	17-Jan-02	3	15.475	4.2008	30.69	61.619
19	A	18-Jan-02	3	15.5	4.2941	31.41	62.9873
19	A	24-Jan-02	3	15.458	4.1347	30.19	60.6488
20	A	10-Jan-02	3	15.542	5.2698	38.58	77.2983
20	A	18-Jan-02	3	15.508	5.6916	42.32	83.485
20	A	23-Jan-02	3	15.492	5.6306	41.2	82.5907
21	A	10-Jan-02	3	15.533	4.9318	36.09	72.3411
21	A	18-Jan-02	3	15.5	5.1524	37.65	75.5767
21	A	23-Jan-02	3	15.483	5.1721	37.9	75.8657
22	A	10-Jan-02	4	15.55	5.1975	38.08	76.2382
22	A	18-Jan-02	4	15.508	5.5572	40.52	81.5136
22	A	23-Jan-02	4	15.483	5.4661	39.93	80.1785
23	A	10-Jan-02	4	15.533	5.01	36.36	73.4883
23	A	18-Jan-02	4	15.483	5.3032	38.51	77.7879
23	A	14-Jan-02	4	15.492	2.3254	17.18	34.1091
24	A	10-Jan-02	4	15.533	5.1112	37.21	74.9721
24	A	18-Jan-02	4	15.492	5.2121	37.97	76.4526
24	A	14-Jan-02	4	15.508	5.5502	40.49	81.411
25	A	10-Jan-02	5	15.542	4.9221	36.02	72.1989
25	A	18-Jan-02	5	15.492	5.3449	39.12	78.3998
25	A	23-Jan-02	5	15.483	5.2901	38.72	77.5961
26*	A	17-Jan-02	5	15.55	16.7527	110.18	245.7326
26*	A	18-Jan-02	5	15.55	16.9665	111.43	248.8679
26*	A	23-Jan-02	5	15.542	16.1858	107.37	237.4164
27	A	18-Jan-02	5	15.483	4.171	30.5	61.1814
27	A	23-Jan-02	5	15.467	4.4003	32.29	64.5439
27	A	14-Jan-02	5	15.492	2.7733	20.48	40.6791
28	A	10-Jan-02	6	15.533	3.9235	28.34	57.5506
28	A	18-Jan-02	6	15.483	4.7207	33.99	69.2449
28	A	23-Jan-02	6	15.475	4.3582	31.56	63.9267
29	A	10-Jan-02	6	15.542	5.3392	39.12	78.3163
29	A	18-Jan-02	6	15.508	5.7098	41.65	83.7533



Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
29	A	23-Jan-02	6	15.483	5.5045	40.29	80.7418
30	A	10-Jan-02	6	15.542	5.3693	39.24	78.7585
30	A	18-Jan-02	6	15.508	5.672	41.41	83.1986
30	A	24-Jan-02	6	15.483	5.7163	41.76	83.8483
31	A	10-Jan-02	5	15.517	4.5491	32.92	66.7269
31	A	18-Jan-02	5	15.483	4.9619	36.03	72.783
31	A	14-Jan-02	5	15.5	2.9986	22.06	43.9839
32	A	17-Jan-02	5	15.508	4.5149	33.08	66.2252
32	A	18-Jan-02	5	15.492	4.9833	36.33	73.0964
32	A	23-Jan-02	5	15.467	4.6927	34.21	68.8336
33	A	18-Jan-02	5	15.5	5.6555	41.27	82.9556
33	A	23-Jan-02	5	15.483	5.5493	40.52	81.3989
33	A	14-Jan-02	5	15.508	5.4801	40.02	80.3837
34	A	22-Jan-02	8	15.5	3.7684	27.71	55.2764
34	A	10-Jan-02	8	15.517	3.6024	26.39	52.8405
34	A	24-Jan-02	8	15.467	3.9373	28.83	57.7528
35	A	22-Jan-02	8	15.517	5.3283	39.05	78.1564
35	A	10-Jan-02	8	15.533	5.2278	38.26	76.6826
35	A	24-Jan-02	8	15.483	5.3873	39.38	79.0224
36	A	17-Jan-02	8	15.517	5.3995	39.54	79.2017
36	A	22-Jan-02	8	15.508	5.4482	39.8	79.9155
36	A	24-Jan-02	8	15.475	5.0249	36.86	73.7071
37	A	22-Jan-02	7	15.508	5.461	39.95	80.1035
37	A	10-Jan-02	7	15.533	5.3949	39.35	79.1342
37	A	24-Jan-02	7	15.492	5.4304	39.71	79.6544
38	A	22-Jan-02	7	15.492	4.2268	30.96	61.9999
38	A	10-Jan-02	7	15.517	4.2414	30.98	62.2145
38	A	24-Jan-02	7	15.458	4.3351	31.65	63.5877
39	A	17-Jan-02	7	15.492	4.4552	32.58	65.3493
39	A	22-Jan-02	7	15.5	4.4985	32.74	65.9851
39	A	24-Jan-02	7	15.467	4.4229	32.42	64.8762
40	A	17-Jan-02	8	15.483	4.5375	33.03	66.5571
40	A	22-Jan-02	8	15.492	4.3295	31.52	63.5066
40	A	24-Jan-02	8	15.458	4.5454	33	66.6723
41	A	22-Jan-02	8	15.492	5.3688	38.88	78.7506
41	A	10-Jan-02	8	15.533	6.1978	44.65	90.9106
41	A	24-Jan-02	8	15.467	5.2746	38.41	77.3691
42	A	17-Jan-02	8	15.492	4.5308	33	66.4594
42	A	22-Jan-02	8	15.492	4.7237	34.32	69.2884
42	A	24-Jan-02	8	15.467	4.8544	35.42	71.2048
43	A	22-Jan-02	9	15.5	5.5624	40.39	81.5908
43	A	10-Jan-02	9	15.517	5.2035	37.79	76.3264
43	A	14-Jan-02	9	15.508	5.8331	42.56	85.562
44	A	22-Jan-02	9	15.483	3.3414	24.38	49.0128

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
44	A	10-Jan-02	9	15.5	3.1699	23.2	46.4961
44	A	14-Jan-02	9	15.492	4.3655	31.71	64.034
45	A	22-Jan-02	9	15.525	10.3961	72.98	152.4919
45	A	10-Jan-02	9	15.558	11.6695	80.43	171.1706
45	A	24-Jan-02	9	15.5	10.0825	71	147.8928
46	A	17-Jan-02	10	15.483	4.5728	33.41	67.0745
46	A	22-Jan-02	10	15.483	4.2194	30.73	61.8912
46	A	24-Jan-02	10	15.458	3.8365	28.16	56.2751
47	A	17-Jan-02	10	15.475	2.7932	20.45	40.9715
47	A	22-Jan-02	10	15.475	3.023	22.12	44.3416
47	A	24-Jan-02	10	15.458	2.7244	20.02	39.9615
48	A	22-Jan-02	10	15.542	11.5687	80.07	169.6924
48	A	10-Jan-02	10	15.55	10.7214	74.74	157.2636
48	A	14-Jan-02	10	15.542	11.4757	79.73	168.3287
49	A	22-Jan-02	11	15.5	5.728	41.42	84.0192
49	A	10-Jan-02	11	15.517	5.0427	36.69	73.9677
49	A	24-Jan-02	11	15.483	5.4205	39.6	N/D
50*	A	22-Jan-02	11	15.567	18.6167	120.28	273.0741
50*	A	10-Jan-02	11	15.592	18.6403	119.53	273.4196
50	A	24-Jan-02	11	15.558	18.0111	117.25	N/D
51	A	22-Jan-02	11	15.492	4.7527	34.54	69.7139
51	A	10-Jan-02	11	15.508	4.3152	31.38	63.296
51	A	24-Jan-02	11	15.475	4.5348	33.18	N/D
52	A	17-Jan-02	12	15.5	5.2612	38.47	77.1728
52	A	22-Jan-02	12	15.5	5.4807	40.03	80.3928
52	A	24-Jan-02	12	15.492	5.2949	38.84	N/D
53	A	17-Jan-02	12	15.5	5.5819	40.81	81.8764
53	A	22-Jan-02	12	15.508	5.585	40.74	81.9225
53	A	24-Jan-02	12	15.492	5.2424	38.47	N/D
54	A	22-Jan-02	12	15.483	4.3088	31.27	63.2026
54	A	10-Jan-02	12	15.508	3.7526	27.35	55.0435
54	A	24-Jan-02	12	15.475	3.9904	29.2	N/D
55	A	22-Jan-02	13	15.492	5.2722	38.36	77.334
55	A	10-Jan-02	13	15.5	4.8267	35.16	70.7992
55	A	24-Jan-02	13	15.475	5.0282	36.71	N/D
56*	A	17-Jan-02	13	15.6	25.6364	154.31	376.04
56*	A	22-Jan-02	13	15.6	26.9418	160.12	395.1882
56	A	24-Jan-02	13	15.592	25.6648	154.55	N/D
57	A	22-Jan-02	13	15.492	5.4229	39.5	79.5448
57	A	10-Jan-02	13	15.508	5.2878	38.53	77.5624
57	A	24-Jan-02	13	15.492	5.6389	41.06	N/D
58	A	22-Jan-02	12	15.492	5.4916	40.08	80.5519
58	A	10-Jan-02	12	15.517	5.2398	38.25	76.858
58	A	24-Jan-02	12	15.483	5.4249	39.62	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
59	A	22-Jan-02	12	15.475	3.6184	26.46	53.0751
59	A	10-Jan-02	12	15.492	3.6083	26.35	52.9274
59	A	24-Jan-02	12	15.475	3.6379	26.67	N/D
60	A	22-Jan-02	12	15.483	4.2944	31.34	62.9914
60	A	10-Jan-02	12	15.492	3.1003	22.67	45.4764
60	A	14-Jan-02	12	15.483	3.3007	24.34	48.4159
61	A	22-Jan-02	13	15.483	3.8723	28.36	56.7995
61	A	10-Jan-02	13	15.492	3.3054	24.27	48.4838
61	A	14-Jan-02	13	15.475	2.9754	21.95	43.6433
62	A	22-Jan-02	13	15.483	4.7771	34.91	70.0722
62	A	10-Jan-02	13	15.508	4.275	31.25	62.7063
62	A	24-Jan-02	13	15.475	5.0882	37.23	N/D
63	A	22-Jan-02	13	15.508	7.073	51.09	103.7483
63*	A	10-Jan-02	13	15.558	14.312	96.2	209.9321
63	A	14-Jan-02	13	15.5	5.5436	40.37	81.3154
64	A	22-Jan-02	14	15.492	5.4132	39.49	79.4016
64	A	10-Jan-02	14	15.492	4.3497	31.79	63.8024
64	A	24-Jan-02	14	15.475	4.7614	34.86	N/D
65	A	17-Jan-02	14	15.492	5.1955	38.05	76.2081
65	A	22-Jan-02	14	15.508	5.9332	43.25	87.0289
65	A	24-Jan-02	14	15.483	5.5158	40.32	N/D
66	A	17-Jan-02	14	15.483	4.9687	36.23	72.8814
66	A	23-Jan-02	14	15.492	5.89	42.65	86.3964
66	A	24-Jan-02	14	15.475	4.9323	36.1	N/D

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix R: Chloride, Strata B

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	B	25-Jan-02	1	15.5	4.8732	35.88	71.4822
1	B	17-Jan-02	1	15.483	4.5703	33.52	67.0387
1	B	15-Jan-02	1	15.517	4.0243	29.63	59.0293
2	B	25-Jan-02	1	15.475	3.46	25.43	50.7527
2	B	13-Jan-02	1	15.517	3.3648	24.54	49.3562
2	B	15-Jan-02	1	15.5	3.3741	24.7	49.4929
3	B	25-Jan-02	1	15.492	5.2222	38.26	76.6012
3	B	13-Jan-02	1	15.525	5.1133	37.45	75.0042
3	B	15-Jan-02	1	15.542	5.0714	37.1	74.389
4	B	25-Jan-02	2	15.483	5.4416	39.93	79.8188
4	B	13-Jan-02	2	15.525	5.5439	40.58	81.3199
4	B	15-Jan-02	2	15.533	5.5528	40.58	81.45
5	B	25-Jan-02	2	15.475	3.8504	28.26	56.4794
5	B	17-Jan-02	2	15.475	3.8159	27.93	55.9732
5	B	15-Jan-02	2	15.5	3.8184	27.82	56.0098
6	B	25-Jan-02	2	15.467	4.0092	29.41	58.8078
6	B	13-Jan-02	2	15.508	3.974	28.97	58.2922
6	B	15-Jan-02	2	15.508	4.1343	30.19	60.6429
7	B	25-Jan-02	1	15.475	5.2676	38.54	77.2676
7	B	17-Jan-02	1	15.492	5.1917	37.83	76.1534
7	B	15-Jan-02	1	15.517	4.9348	36.04	72.3854
8	B	25-Jan-02	1	15.467	4.6223	33.81	67.8021
8	B	13-Jan-02	1	15.508	4.6875	34.09	68.7572
8	B	15-Jan-02	1	15.517	4.6211	33.73	67.7833
9	B	25-Jan-02	1	15.483	5.4424	39.9	79.8315
9	B	13-Jan-02	1	15.525	5.5617	40.69	81.581
9	B	15-Jan-02	1	15.525	5.6497	41.27	82.8717
10	B	25-Jan-02	2	15.483	5.5851	40.91	81.9244
10	B	13-Jan-02	2	15.525	5.4344	39.82	79.7141
10	B	15-Jan-02	2	15.525	5.7705	42.09	84.6439
11	B	25-Jan-02	2	15.458	3.2259	23.71	47.3193
11	B	13-Jan-02	2	15.5	3.2739	23.96	48.0224
11	B	15-Jan-02	2	15.5	3.5143	25.71	51.5495
12	B	25-Jan-02	2	15.467	4.4944	32.75	65.9255
12	B	13-Jan-02	2	15.508	4.4776	32.42	65.6788
12	B	15-Jan-02	2	15.508	4.5329	32.86	66.4894
13	B	17-Jan-02	3	15.467	3.9093	28.55	57.3425
14	B	25-Jan-02	3	15.475	4.7022	34.19	68.9735
14	B	13-Jan-02	3	15.508	4.8276	34.94	70.8137
14	B	15-Jan-02	3	15.508	4.98	36.08	73.048
15	B	25-Jan-02	3	15.475	4.9854	36.29	73.1277
15	B	13-Jan-02	3	15.508	4.9882	36.13	73.1693
15	B	15-Jan-02	3	15.5	5.0173	36.39	73.5956

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
16	B	25-Jan-02	4	15.475	5.3093	38.85	77.8787
16	B	13-Jan-02	4	15.517	5.491	40.01	80.5436
16	B	15-Jan-02	4	15.517	5.5829	40.71	81.8923
17	B	25-Jan-02	4	15.45	3.2195	23.55	47.2249
17	B	17-Jan-02	4	15.467	3.215	23.57	47.1589
17	B	15-Jan-02	4	15.5	3.3787	24.65	49.5603
18	B	25-Jan-02	4	15.458	3.8427	28.09	56.3668
18	B	17-Jan-02	4	15.467	3.7834	27.6	55.4956
18	B	15-Jan-02	4	15.508	3.8967	28.27	57.1578
19	B	25-Jan-02	3	15.467	4.1032	29.93	60.1869
19	B	17-Jan-02	3	15.475	3.9966	29.05	58.6239
19	B	16-Jan-02	3	15.5	3.9935	29.2	58.5775
20	B	25-Jan-02	3	15.475	5.2593	38.56	77.1457
20	B	13-Jan-02	3	15.525	5.5694	40.67	81.6944
20	B	15-Jan-02	3	15.525	5.5226	40.36	81.0069
21	B	25-Jan-02	3	15.475	5.3848	39.33	78.9868
21	B	13-Jan-02	3	15.525	5.3169	38.88	77.9902
21	B	15-Jan-02	3	15.525	5.2946	38.68	77.6626
22	B	25-Jan-02	4	15.483	5.5597	40.65	81.5512
22	B	13-Jan-02	4	15.517	5.5824	40.84	81.885
22	B	15-Jan-02	4	15.525	5.532	40.43	81.146
23	B	25-Jan-02	4	15.475	5.4308	39.7	79.661
23	B	13-Jan-02	4	15.517	5.4081	39.44	79.3276
23	B	15-Jan-02	4	15.517	5.5278	40.29	81.0839
24	B	25-Jan-02	4	15.467	3.6136	26.61	53.0048
24	B	13-Jan-02	4	15.5	3.6182	26.41	53.0733
24	B	15-Jan-02	4	15.5	3.6593	26.81	53.6759
25	B	25-Jan-02	5	15.475	4.8015	35.04	70.4304
25	B	13-Jan-02	5	15.5	4.6795	33.99	68.64
25	B	15-Jan-02	5	15.508	4.4771	32.61	65.672
26	B	25-Jan-02	5	15.467	3.4489	25.37	50.5897
26	B	13-Jan-02	5	15.492	3.5269	25.73	51.7343
26	B	15-Jan-02	5	15.492	3.5784	26.1	52.4891
27	B	25-Jan-02	5	15.467	3.8033	27.81	55.7888
27	B	13-Jan-02	5	15.492	3.7469	27.26	54.9606
27	B	15-Jan-02	5	15.492	3.8461	27.95	56.4162
28	B	25-Jan-02	6	15.475	5.1282	37.39	75.2223
28	B	13-Jan-02	6	15.5	5.0931	37	74.7076
28	B	15-Jan-02	6	15.5	5.2287	37.83	76.6965
29	B	25-Jan-02	6	15.483	5.6326	41.17	82.6206
29	B	13-Jan-02	6	15.517	5.6063	40.93	82.2355
29	B	15-Jan-02	6	15.517	5.7343	41.88	84.1132
30	B	25-Jan-02	6	15.475	4.6321	33.87	67.9451
30	B	13-Jan-02	6	15.5	4.726	34.54	69.3227

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
30	B	15-Jan-02	6	15.508	4.7064	34.34	69.0347
31	B	25-Jan-02	5	15.467	4.9033	35.9	71.9239
31	B	13-Jan-02	5	15.5	5.1304	37.32	75.2541
31	B	15-Jan-02	5	15.508	5.2656	38.28	77.238
32	B	13-Jan-02	5	15.5	4.4432	32.39	65.1739
32	B	15-Jan-02	5	15.5	4.5487	33.08	66.7226
32	B	16-Jan-02	5	15.517	4.5828	33.38	67.2224
33	B	25-Jan-02	5	15.483	5.5286	40.45	81.0956
33	B	13-Jan-02	5	15.517	5.542	40.53	81.2923
33	B	15-Jan-02	5	15.508	5.5208	40.26	80.981
34	B	16-Jan-02	8	15.508	4.8901	35.54	71.7298
34	B	26-Jan-02	8	15.5	5.037	36.75	73.8842
34	B	13-Jan-02	8	15.542	5.0023	36.43	73.3753
35	B	16-Jan-02	8	15.525	5.3135	38.92	77.9409
35	B	26-Jan-02	8	15.5	5.297	38.81	77.6985
35	B	13-Jan-02	8	15.542	5.3579	39.29	78.5917
36	B	16-Jan-02	8	15.508	5.3583	39.03	78.5971
36	B	26-Jan-02	8	15.492	5.4425	39.77	79.8327
36	B	13-Jan-02	8	15.533	5.3638	39.22	78.6784
37	B	26-Jan-02	7	15.475	4.3916	32.25	64.4176
37	B	13-Jan-02	7	15.517	4.2994	31.45	63.0645
37	B	23-Jan-02	7	15.492	4.4332	32.4	65.0276
38	B	16-Jan-02	7	15.5	3.6927	27.02	54.1657
38	B	26-Jan-02	7	15.467	3.7564	27.58	55.1004
38	B	13-Jan-02	7	15.517	3.5087	25.8	51.4671
39	B	16-Jan-02	7	15.5	4.2936	31.29	62.9796
39	B	26-Jan-02	7	15.475	4.6737	34.06	68.5559
39	B	13-Jan-02	7	15.517	4.5602	33.25	66.8908
40	B	16-Jan-02	8	15.492	3.8754	28.2	56.846
40	B	26-Jan-02	8	15.475	4.0444	29.54	59.3248
40	B	13-Jan-02	8	15.517	3.9396	28.79	57.7879
41	B	16-Jan-02	8	15.5	3.9217	28.5	57.5254
41	B	26-Jan-02	8	15.467	4.149	30.35	60.8584
41	B	13-Jan-02	8	15.517	4.0967	29.91	60.0917
42	B	16-Jan-02	8	15.508	4.8135	35	70.6056
42	B	26-Jan-02	8	15.467	4.9961	36.44	73.2847
42	B	13-Jan-02	8	15.517	4.8253	35.11	70.7786
43	B	16-Jan-02	9	15.492	3.8308	27.82	56.1915
43	B	26-Jan-02	9	15.458	4.11	29.97	60.2872
43	B	13-Jan-02	9	15.508	4.2855	31.2	62.8607
44	B	16-Jan-02	9	15.492	3.3887	24.84	49.7073
44	B	26-Jan-02	9	15.458	3.5411	25.98	51.9426
44	B	13-Jan-02	9	15.5	3.522	25.89	51.6619
45	B	16-Jan-02	9	15.5	4.2256	30.88	61.9826

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
45	B	26-Jan-02	9	15.467	3.9784	29.22	58.3566
45	B	13-Jan-02	9	15.508	4.2863	31.33	62.8729
46	B	16-Jan-02	10	15.492	3.5376	25.7	51.8912
46	B	26-Jan-02	10	15.467	3.5616	25.96	52.2425
46	B	13-Jan-02	10	15.5	3.5646	25.99	52.2875
47	B	16-Jan-02	10	15.483	2.7161	19.82	39.8412
47	B	26-Jan-02	10	15.45	2.8279	20.72	41.4801
47	B	13-Jan-02	10	15.5	2.8406	20.75	41.6666
48	B	15-Jan-02	10	15.5	4.6317	33.94	67.9395
48	B	16-Jan-02	10	15.5	3.6587	26.82	53.6677
48	B	13-Jan-02	10	15.517	5.2499	38.46	77.0073
49*	B	16-Jan-02	11	15.517	8.0351	57.28	117.8619
49*	B	26-Jan-02	11	15.483	7.1001	51.08	104.1466
49*	B	13-Jan-02	11	15.525	7.1621	51.45	105.0567
50	B	26-Jan-02	11	15.458	3.8695	28.42	56.7591
50	B	13-Jan-02	11	15.5	3.4459	25.24	50.5459
50	B	23-Jan-02	11	15.483	3.3085	24.21	48.5302
51	B	16-Jan-02	11	15.5	5.3245	38.83	78.1017
51	B	26-Jan-02	11	15.475	5.3007	38.75	77.752
51	B	13-Jan-02	11	15.517	5.3667	39.19	78.7209
52	B	16-Jan-02	12	15.5	5.1264	37.43	75.1956
52	B	26-Jan-02	12	15.467	4.5675	33.57	66.9977
52	B	13-Jan-02	12	15.517	5.3586	39.16	78.6024
53	B	16-Jan-02	12	15.5	5.3004	38.74	77.7477
53	B	26-Jan-02	12	15.475	5.3419	39.02	78.3566
53	B	13-Jan-02	12	15.525	5.4563	39.8	80.0353
54	B	16-Jan-02	12	15.492	4.6483	33.85	68.1822
54	B	26-Jan-02	12	15.467	4.8995	35.8	71.8678
54	B	13-Jan-02	12	15.508	4.7648	34.82	69.8924
55	B	16-Jan-02	13	15.483	3.1519	23.03	46.2337
55	B	26-Jan-02	13	15.45	3.1239	22.94	45.8228
55	B	13-Jan-02	13	15.492	3.1526	23.1	46.2433
56	B	15-Jan-02	13	15.5	3.7759	27.78	55.3861
56	B	16-Jan-02	13	15.467	2.2667	16.65	33.248
57	B	16-Jan-02	13	15.5	4.928	36.09	72.286
57	B	26-Jan-02	13	15.467	5.1019	37.28	74.8362
57	B	13-Jan-02	13	15.508	5.3129	38.78	77.9314
58	B	16-Jan-02	12	15.508	5.1984	38.06	76.2526
58	B	26-Jan-02	12	15.475	5.2041	38.17	76.3358
58	B	13-Jan-02	12	15.517	5.465	39.98	80.1631
59	B	16-Jan-02	12	15.483	3.308	24.15	48.5223
59	B	26-Jan-02	12	15.458	3.2102	23.58	47.0883
59	B	13-Jan-02	12	15.5	3.2303	23.7	47.3833
60	B	16-Jan-02	12	15.492	4.4962	32.54	65.9523

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
60	B	26-Jan-02	12	15.467	4.5853	33.49	67.2592
60	B	13-Jan-02	12	15.5	4.667	33.86	68.4568
61	B	16-Jan-02	13	15.483	2.6649	19.42	39.0898
61	B	26-Jan-02	13	15.45	2.6439	19.45	38.7817
61	B	13-Jan-02	13	15.483	2.8467	20.74	41.757
62	B	16-Jan-02	13	15.483	2.5246	18.43	37.0321
62	B	26-Jan-02	13	15.45	2.5563	18.81	37.4963
62	B	13-Jan-02	13	15.492	2.5507	18.73	37.414
63	B	16-Jan-02	13	15.475	2.7021	19.75	39.6356
63	B	26-Jan-02	13	15.45	3.0199	22.16	44.2967
63	B	13-Jan-02	13	15.492	2.6164	19.19	38.3778
64	B	16-Jan-02	14	15.5	4.8743	35.57	71.498
64	B	26-Jan-02	14	15.467	5.0622	37.05	74.2535
64	B	13-Jan-02	14	15.5	4.8623	35.58	71.3217
65	B	16-Jan-02	14	15.5	5.2667	38.49	77.2539
65	B	26-Jan-02	14	15.467	5.4088	39.57	79.338
65	B	13-Jan-02	14	15.517	5.5357	40.34	81.1989
66	B	16-Jan-02	14	15.492	4.752	34.66	69.7041
66	B	26-Jan-02	14	15.467	4.9345	36.09	72.3806
66	B	13-Jan-02	14	15.508	4.8813	35.45	71.6011

\*—JMP 4.0 Outlier

N/D—Not Detected



### Appendix S: Chloride, Strata C

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	C	16-Jan-02	1	15.533	5.4561	39.98	80.0313
1	C	17-Jan-02	1	15.517	5.7159	41.75	83.8432
1	C	26-Jan-02	1	15.508	5.615	41.21	82.3627
2	C	16-Jan-02	1	15.525	5.6457	41.33	82.8133
2	C	17-Jan-02	1	15.517	5.521	40.32	80.9847
2	C	26-Jan-02	1	15.5	5.5586	40.76	81.535
3	C	16-Jan-02	1	15.517	5.3621	39.3	78.6532
3	C	17-Jan-02	1	15.508	5.6651	41.39	83.0977
3	C	26-Jan-02	1	15.5	5.6054	40.97	82.222
4	C	16-Jan-02	2	15.517	5.5878	40.88	81.9641
4	C	17-Jan-02	2	15.508	5.3748	39.31	78.8401
4	C	26-Jan-02	2	15.5	5.605	41.06	82.2163
5	C	16-Jan-02	2	15.517	5.5086	40.33	80.8022
5	C	17-Jan-02	2	15.508	5.6697	41.42	83.1652
5	C	26-Jan-02	2	15.5	5.5679	40.8	81.6723
7	C	16-Jan-02	1	15.517	5.6354	41.12	82.6625
7	C	26-Jan-02	1	15.492	5.5261	40.48	81.0594
7	C	22-Jan-02	1	15.5	5.6229	41.08	82.4784
8	C	26-Jan-02	1	15.492	5.6995	41.73	83.6017
8	C	23-Jan-02	1	15.5	5.6526	41.35	82.9138
8	C	22-Jan-02	1	15.5	5.6468	41.17	82.8288
9	C	16-Jan-02	1	15.517	6.1029	44.49	89.5193
9	C	26-Jan-02	1	15.483	5.6365	41.15	82.6775
9	C	22-Jan-02	1	15.5	5.7089	41.59	83.7394
10	C	16-Jan-02	2	15.517	5.7118	41.75	83.7831
10	C	26-Jan-02	2	15.492	5.6831	41.51	83.3618
10	C	6-Jan-02	2	15.342	5.1271	37.12	75.2055
11	C	16-Jan-02	2	15.508	5.6372	41.1	82.6888
11	C	26-Jan-02	2	15.492	5.6674	41.5	83.1319
11	C	6-Jan-02	2	15.483	5.496	40.06	80.6167
12	C	16-Jan-02	2	15.508	5.5284	40.37	81.0924
12	C	26-Jan-02	2	15.483	5.5712	40.7	81.7204
12	C	23-Jan-02	2	15.492	5.6991	41.6	83.5961
13	C	16-Jan-02	3	15.517	5.5162	40.3	80.9137
13	C	10-Jan-02	3	15.367	5.3852	39	78.9918
13	C	26-Jan-02	3	15.483	5.6354	41.19	82.6627
14	C	10-Jan-02	3	15.467	5.3582	39.09	78.5964
14	C	26-Jan-02	3	15.483	5.6322	41.17	82.6151
14	C	23-Jan-02	3	15.483	5.6895	41.46	83.4555
15	C	10-Jan-02	3	15.508	5.4716	39.9	80.2598
15	C	26-Jan-02	3	15.483	5.3691	39.37	78.7562
15	C	23-Jan-02	3	15.492	5.7047	41.66	83.6781
16	C	10-Jan-02	4	15.517	5.2849	38.68	77.5209

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
16	C	26-Jan-02	4	15.483	5.5017	40.28	80.7005
16	C	6-Jan-02	4	15.525	4.9893	36.52	73.1851
17	C	10-Jan-02	4	15.533	5.306	38.86	77.8308
17	C	26-Jan-02	4	15.492	5.4869	40.16	80.4836
17	C	23-Jan-02	4	15.492	5.6486	41.19	82.855
18	C	10-Jan-02	4	15.533	5.2493	38.52	76.9989
18	C	26-Jan-02	4	15.483	5.6379	41.19	82.699
18	C	23-Jan-02	4	15.492	5.7262	41.81	83.9944
19	C	16-Jan-02	3	15.517	5.7	41.53	83.6101
19	C	10-Jan-02	3	15.533	5.3561	39.23	78.5645
20	C	16-Jan-02	3	15.508	5.549	40.59	81.394
20	C	10-Jan-02	3	15.542	5.7938	42.31	84.9851
20	C	26-Jan-02	3	15.517	4.9043	36.13	71.9375
21	C	10-Jan-02	3	15.542	5.4977	40.15	80.6428
21*	C	26-Jan-02	3	15.467	0.0204	0.16	0.2991
21	C	6-Jan-02	3	15.55	5.1518	37.85	75.5684
22	C	5-Jan-02	4	15.142	5.0342	35.97	73.8429
22	C	10-Jan-02	4	15.542	5.4338	39.77	79.7045
22	C	6-Jan-02	4	15.567	5.4192	39.63	79.491
23	C	5-Jan-02	4	15.4	5.0999	36.96	74.8073
23	C	10-Jan-02	4	15.55	5.4903	40.12	80.5337
23	C	6-Jan-02	4	15.558	5.2043	38.17	76.3382
24	C	5-Jan-02	4	15.492	5.229	38.12	76.701
24	C	10-Jan-02	4	15.542	5.4038	39.52	79.2641
24	C	6-Jan-02	4	15.567	5.0684	37.28	74.3457
25	C	5-Jan-02	5	15.533	5.1942	38.05	76.191
25	C	10-Jan-02	5	15.542	5.4066	39.53	79.3061
25*	C	28-Jan-02	5	15.475	3.0228	22.39	44.3396
26	C	10-Jan-02	5	15.542	5.3717	39.31	78.7943
26	C	28-Jan-02	5	15.492	5.5665	40.73	81.6512
26	C	23-Jan-02	5	15.492	5.7383	41.76	84.1717
27	C	10-Jan-02	5	15.542	5.555	40.61	81.4825
27	C	28-Jan-02	5	15.492	5.6322	41.1	82.6145
27	C	23-Jan-02	5	15.492	5.894	43.02	86.4554
28	C	5-Jan-02	6	15.542	5.2831	38.67	77.4946
28	C	10-Jan-02	6	15.542	5.4017	39.44	79.2346
28	C	6-Jan-02	6	15.567	5.1204	37.54	75.1076
29	C	5-Jan-02	6	15.55	5.1079	37.45	74.9239
29	C	10-Jan-02	6	15.55	5.3736	39.33	78.8221
29	C	6-Jan-02	6	15.558	4.9812	36.58	73.0655
30	C	5-Jan-02	6	15.55	4.8542	35.56	71.2037
30	C	10-Jan-02	6	15.542	5.4352	39.72	79.7261
30	C	6-Jan-02	6	15.567	5.882	43.03	86.2796
31	C	5-Jan-02	5	15.558	5.1067	37.49	74.9064

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
31	C	10-Jan-02	5	15.542	5.417	39.67	79.4587
31	C	28-Jan-02	5	15.492	5.7937	42.28	84.9839
32	C	10-Jan-02	5	15.55	5.4485	39.78	79.9206
32	C	28-Jan-02	5	15.483	5.5956	40.86	82.0777
32	C	23-Jan-02	5	15.492	5.6602	41.37	83.0253
33	C	10-Jan-02	5	15.542	5.3524	39.17	78.5104
33	C	28-Jan-02	5	15.475	5.4667	39.92	80.1871
33	C	23-Jan-02	5	15.5	5.6089	40.99	82.2729
34	C	5-Jan-02	8	15.567	5.1331	37.71	75.2935
34	C	10-Jan-02	8	15.533	5.4105	39.59	79.3638
34	C	6-Jan-02	8	15.567	5.1063	37.5	74.9007
35	C	5-Jan-02	8	15.567	5.4015	39.56	79.2311
35	C	10-Jan-02	8	15.542	5.4506	39.89	79.9509
35	C	6-Jan-02	8	15.558	5.2678	38.6	77.2699
36	C	5-Jan-02	8	15.567	5.069	37.23	74.3532
36	C	10-Jan-02	8	15.55	5.4437	39.78	79.8503
36	C	6-Jan-02	8	15.558	5.3159	38.97	77.9753
37	C	5-Jan-02	7	15.558	5.1569	37.86	75.6439
37	C	10-Jan-02	7	15.533	5.1505	37.71	75.5498
37*	C	28-Jan-02	7	15.433	0.0043	0.03	0.0629
37	C	6-Jan-02	7	15.558	5.4978	40.2	80.643
38	C	10-Jan-02	7	15.542	5.5911	40.87	82.0116
38	C	28-Jan-02	7	15.483	5.6725	41.41	83.2064
38	C	6-Jan-02	7	15.558	5.6852	41.59	83.393
39	C	10-Jan-02	7	15.542	5.8779	42.89	86.2188
39	C	28-Jan-02	7	15.483	5.5357	40.48	81.1999
39	C	23-Jan-02	7	15.492	5.7563	42.04	84.436
40	C	10-Jan-02	8	15.542	5.5534	40.61	81.459
40	C	28-Jan-02	8	15.483	5.522	40.27	80.9991
40	C	23-Jan-02	8	15.492	5.6091	40.99	82.2764
41	C	10-Jan-02	8	15.533	5.5854	40.75	81.9285
41	C	28-Jan-02	8	15.483	5.5875	40.86	81.9593
41	C	6-Jan-02	8	15.558	5.3384	39.07	78.3057
42	C	10-Jan-02	8	15.542	5.5775	40.68	81.813
42	C	28-Jan-02	8	15.475	5.4735	39.99	80.2868
42	C	23-Jan-02	8	15.492	5.6549	41.33	82.9478
43	C	10-Jan-02	9	15.533	5.4691	39.98	80.2227
43	C	28-Jan-02	9	15.475	5.4733	40.01	80.2847
43	C	6-Jan-02	9	15.558	5.807	42.44	85.1794
44	C	10-Jan-02	9	15.542	6.087	44.26	89.2857
44	C	28-Jan-02	9	15.475	5.5375	40.43	81.2265
44	C	23-Jan-02	9	15.492	5.678	41.46	83.287
45	C	10-Jan-02	9	15.542	5.6267	41.11	82.5346
45	C	28-Jan-02	9	15.483	5.6672	41.39	83.1283

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
45	C	23-Jan-02	9	15.492	5.7549	42.05	84.4155
46	C	28-Jan-02	10	15.475	5.5434	40.52	81.3133
46	C	10-Jan-02	10	15.558	5.5096	40.41	80.8175
46	C	23-Jan-02	10	15.492	5.5473	40.56	81.3698
47	C	28-Jan-02	10	15.483	5.6053	40.88	82.2203
47	C	10-Jan-02	10	15.55	5.4423	39.81	79.83
47	C	23-Jan-02	10	15.492	5.6169	40.98	82.3903
48	C	28-Jan-02	10	15.483	5.3728	39.36	78.8103
48	C	10-Jan-02	10	15.542	5.4228	39.69	79.544
48	C	6-Jan-02	10	15.55	5.3302	38.99	78.1851
49	C	28-Jan-02	11	15.475	5.5698	40.66	81.7004
49	C	10-Jan-02	11	15.542	5.5424	40.56	81.2984
49	C	6-Jan-02	11	15.55	5.0512	36.97	74.0928
50	C	28-Jan-02	11	15.475	5.6462	41.26	82.8201
50	C	10-Jan-02	11	15.542	5.6204	41.14	82.4417
50	C	6-Jan-02	11	15.558	5.304	38.91	77.8007
51	C	28-Jan-02	11	15.483	5.8452	42.68	85.7401
51	C	10-Jan-02	11	15.542	5.8156	42.55	85.3055
51	C	6-Jan-02	11	15.558	5.3038	38.83	77.7979
52	C	28-Jan-02	12	15.475	5.5245	40.37	81.0355
52	C	10-Jan-02	12	15.542	5.7619	42.15	84.5176
52	C	23-Jan-02	12	15.492	5.8283	42.55	85.4922
53	C	28-Jan-02	12	15.483	5.848	42.69	85.781
53	C	10-Jan-02	12	15.542	5.7924	42.24	84.9644
53	C	23-Jan-02	12	15.483	5.8667	42.79	86.0551
54	C	28-Jan-02	12	15.483	5.6604	41.39	83.0281
54	C	10-Jan-02	12	15.533	5.7428	41.87	84.2368
54	C	23-Jan-02	12	15.492	5.6968	41.53	83.5633
55	C	28-Jan-02	13	15.483	5.518	40.29	80.9398
55	C	10-Jan-02	13	15.533	5.4103	39.61	79.3601
55	C	23-Jan-02	13	15.492	5.6339	41.15	82.6395
56	C	28-Jan-02	13	15.475	5.3777	39.34	78.8814
56	C	10-Jan-02	13	15.533	5.4716	40.03	80.2597
56	C	23-Jan-02	13	15.492	5.7212	41.7	83.9205
57	C	28-Jan-02	13	15.483	5.6246	41.01	82.5029
57	C	10-Jan-02	13	15.533	5.5038	40.26	80.7324
57	C	23-Jan-02	13	15.492	5.7541	41.97	84.4028
58	C	28-Jan-02	12	15.475	5.474	40.04	80.2939
58	C	10-Jan-02	12	15.533	5.5824	40.84	81.8853
58	C	23-Jan-02	12	15.483	5.5949	40.81	82.0676
59	C	28-Jan-02	12	15.483	5.5295	40.48	81.1088
59	C	10-Jan-02	12	15.533	5.6844	41.56	83.3809
59	C	23-Jan-02	12	15.483	5.8399	42.55	85.6619
60	C	28-Jan-02	12	15.475	5.6195	41	82.4281

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
60	C	10-Jan-02	12	15.533	5.5729	40.71	81.7457
60	C	6-Jan-02	12	15.558	5.9756	43.59	87.6524
61	C	28-Jan-02	13	15.475	5.373	39.34	78.8136
61	C	10-Jan-02	13	15.533	5.4201	39.7	79.5038
61	C	23-Jan-02	13	15.483	5.6256	41.02	82.5183
62	C	28-Jan-02	13	15.483	5.6452	41.17	82.8054
62	C	10-Jan-02	13	15.533	5.4907	40.2	80.5394
62	C	23-Jan-02	13	15.492	5.6596	41.24	83.0168
63	C	28-Jan-02	13	15.475	5.3133	38.85	77.9374
63	C	10-Jan-02	13	15.533	5.3928	39.52	79.1032
63	C	23-Jan-02	13	15.483	5.6748	41.37	83.2395
64	C	28-Jan-02	14	15.475	5.3338	39.04	78.2384
64	C	10-Jan-02	14	15.533	5.6451	41.2	82.8048
64	C	23-Jan-02	14	15.492	5.6414	41.17	82.7501
65	C	28-Jan-02	14	15.475	5.5655	40.6	81.6365
65	C	10-Jan-02	14	15.533	5.5882	40.87	81.9703
65	C	23-Jan-02	14	15.483	5.8334	42.53	85.5661
66	C	28-Jan-02	14	15.475	5.4198	39.67	79.4996
66	C	10-Jan-02	14	15.533	5.5381	40.42	81.2347
66	C	23-Jan-02	14	15.5	5.7205	41.78	83.911

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix T: Chloride, Field Blanks, Influent and Effluent

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
Blank	BLANK	10-Jan-02	B	15.458	0.0382	0.29	0.5609
Blank	BLANK	26-Jan-02	B	15.442	0.0134	0.1	0.1971
Blank	BLANK	28-Jan-02	B	15.442	0.0142	0.11	0.2083
Influent	INFLUENT	5-Jan-02	I	15.558	5.24	38.42	76.8617
Influent	INFLUENT	10-Jan-02	I	15.542	5.5445	40.46	81.329
Influent	INFLUENT	6-Jan-02	I	15.558	5.3149	38.82	77.9614
Effluent	EFFLUENT	5-Jan-02	E	15.567	5.0659	37.20	74.3083
Effluent	EFFLUENT	10-Jan-02	E	15.542	5.4200	39.62	79.5024
Effluent	EFFLUENT	6-Jan-02	E	15.558	5.5271	40.29	81.0737

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix U: Fluoride, Strata A

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	A	16-Jan-02	1	7.533	0.0166	0.07	0.1408
1	A	17-Jan-02	1	7.442	0.0147	0.07	0.1246
1	A	23-Jan-02	1	7.558	0.0158	0.07	0.1339
2	A	16-Jan-02	1	7.45	0.0228	0.09	0.1936
2	A	17-Jan-02	1	7.408	0.0163	0.07	0.1385
2	A	23-Jan-02	1	7.475	0.0181	0.08	0.1537
3	A	18-Jan-02	1	7.367	0.0159	0.06	0.1355
3	A	16-Jan-02	1	7.375	0.0222	0.08	0.1881
3	A	17-Jan-02	1	N/D	N/D	N/D	N/D
4	A	18-Jan-02	2	7.408	0.0251	0.1	0.2136
4	A	16-Jan-02	2	7.425	0.0228	0.1	0.1935
4	A	17-Jan-02	2	7.383	0.0217	0.1	0.1846
5	A	18-Jan-02	2	7.383	0.0258	0.09	0.2195
5	A	16-Jan-02	2	7.383	0.026	0.09	0.2213
5	A	17-Jan-02	2	7.35	0.0235	0.09	0.1999
6	A	18-Jan-02	2	7.383	0.0125	0.05	0.106
6	A	16-Jan-02	2	7.4	0.0203	0.07	0.172
6	A	17-Jan-02	2	7.35	0.016	0.06	0.136
7	A	17-Jan-02	1	7.408	0.0143	0.06	0.1217
7	A	23-Jan-02	1	7.425	0.017	0.07	0.1443
8	A	18-Jan-02	1	7.367	0.016	0.06	0.1356
8	A	16-Jan-02	1	7.375	0.0188	0.07	0.1593
8	A	17-Jan-02	1	7.367	0.0129	0.05	0.1095
9	A	18-Jan-02	1	7.408	0.0175	0.08	0.1486
9	A	16-Jan-02	1	7.417	0.0182	0.08	0.1542
9	A	17-Jan-02	1	7.417	0.0184	0.08	0.1566
10	A	18-Jan-02	2	7.45	0.0185	0.08	0.1569
10*	A	10-Jan-02	2	7.567	0.0026	0.01	0.0218
10	A	16-Jan-02	2	7.475	0.0196	0.09	0.1667
10	A	14-Jan-02	2	7.592	0.0102	0.05	0.0868
11	A	18-Jan-02	2	7.375	0.0233	0.09	0.1983
11*	A	10-Jan-02	2	7.758	0.0016	0.01	0.0135
11	A	16-Jan-02	2	7.4	0.0219	0.09	0.1858
11	A	14-Jan-02	2	7.475	0.0176	0.07	0.1498
12	A	18-Jan-02	2	7.375	0.0178	0.07	0.1512
12	A	10-Jan-02	2	7.408	0.0228	0.09	0.1934
12	A	16-Jan-02	2	7.383	0.0244	0.09	0.2075
13	A	18-Jan-02	3	7.383	0.0117	0.05	0.0994
13	A	16-Jan-02	3	7.375	0.0159	0.06	0.135
13	A	17-Jan-02	3	7.367	0.0119	0.05	0.1011
14	A	18-Jan-02	3	7.358	0.0133	0.05	0.113
14	A	23-Jan-02	3	7.358	0.0204	0.07	0.1733
14	A	14-Jan-02	3	7.475	0.013	0.05	0.1102

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
15	A	18-Jan-02	3	7.358	0.021	0.08	0.1785
15	A	17-Jan-02	3	7.392	0.0158	0.07	0.1343
15	A	23-Jan-02	3	7.375	0.0203	0.08	0.1727
16	A	18-Jan-02	4	7.433	0.0166	0.08	0.1413
16	A	10-Jan-02	4	7.525	0.019	0.08	0.1614
16	A	23-Jan-02	4	7.442	0.0176	0.08	0.1491
17	A	17-Jan-02	4	7.358	0.019	0.08	0.161
17	A	18-Jan-02	4	7.508	0.0205	0.08	0.1745
17	A	23-Jan-02	4	7.358	0.0227	0.08	0.1928
18	A	18-Jan-02	4	7.467	0.0222	0.08	0.1884
18	A	23-Jan-02	4	7.375	0.0213	0.08	0.181
18*	A	14-Jan-02	4	7.517	0.006	0.02	0.051
19	A	17-Jan-02	3	7.367	0.0157	0.06	0.1334
19	A	18-Jan-02	3	7.408	0.0197	0.07	0.1669
19	A	24-Jan-02	3	7.35	0.0222	0.07	0.1885
20	A	10-Jan-02	3	7.525	0.0203	0.08	0.1723
20	A	18-Jan-02	3	7.492	0.0193	0.08	0.1639
20	A	23-Jan-02	3	7.45	0.0288	0.09	0.2448
21	A	10-Jan-02	3	7.5	0.0212	0.09	0.18
21	A	18-Jan-02	3	7.458	0.0229	0.1	0.1948
21	A	23-Jan-02	3	7.425	0.0249	0.1	0.2115
22	A	10-Jan-02	4	7.533	0.0195	0.09	0.1658
22	A	18-Jan-02	4	7.475	0.0191	0.09	0.1625
22	A	23-Jan-02	4	7.45	0.0185	0.09	0.157
23	A	10-Jan-02	4	7.433	0.0181	0.07	0.1534
23	A	18-Jan-02	4	7.367	0.0189	0.07	0.1602
23	A	14-Jan-02	4	7.492	0.0137	0.06	0.1162
24	A	10-Jan-02	4	7.433	0.0226	0.09	0.1922
24	A	18-Jan-02	4	7.375	0.0186	0.07	0.1577
24	A	14-Jan-02	4	7.433	0.0155	0.06	0.1315
25	A	10-Jan-02	5	7.492	0.0211	0.09	0.179
25	A	18-Jan-02	5	7.442	0.0216	0.09	0.1831
25	A	23-Jan-02	5	7.45	0.0216	0.1	0.1836
26*	A	17-Jan-02	5	7.8	0.0008	0	0.0069
26	A	18-Jan-02	5	7.367	0.0204	0.06	0.1731
26	A	23-Jan-02	5	7.367	0.0158	0.06	0.1338
27	A	18-Jan-02	5	7.392	0.0216	0.09	0.1839
27	A	23-Jan-02	5	7.383	0.0157	0.06	0.1331
27	A	14-Jan-02	5	7.45	0.0164	0.06	0.1391
28	A	10-Jan-02	6	7.408	0.0196	0.07	0.166
28	A	18-Jan-02	6	N/D	N/D	N/D	N/D
28	A	23-Jan-02	6	N/D	N/D	N/D	N/D
29	A	10-Jan-02	6	7.517	0.0188	0.09	0.1596
29	A	18-Jan-02	6	7.475	0.02	0.09	0.1701



Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
29	A	23-Jan-02	6	7.442	0.0191	0.09	0.1623
30	A	10-Jan-02	6	7.5	0.0188	0.09	0.1594
30	A	18-Jan-02	6	7.475	0.0191	0.09	0.1624
30	A	24-Jan-02	6	7.433	0.0187	0.09	0.1591
31	A	10-Jan-02	5	7.367	0.0179	0.06	0.1517
31	A	18-Jan-02	5	7.367	0.0148	0.06	0.126
31	A	14-Jan-02	5	7.458	0.0109	0.05	0.0926
32	A	17-Jan-02	5	7.483	0.0128	0.05	0.1083
32	A	18-Jan-02	5	7.375	0.0117	0.04	0.0998
32	A	23-Jan-02	5	7.35	0.0153	0.05	0.13
33	A	18-Jan-02	5	7.417	0.0212	0.1	0.18
33	A	23-Jan-02	5	7.417	0.0217	0.1	0.1841
33	A	14-Jan-02	5	7.475	0.0217	0.09	0.1845
34	A	22-Jan-02	8	7.517	0.0214	0.08	0.1815
34	A	10-Jan-02	8	7.417	0.0225	0.08	0.1914
34	A	24-Jan-02	8	7.375	0.0239	0.09	0.2033
35	A	22-Jan-02	8	7.542	0.0236	0.1	0.2002
35	A	10-Jan-02	8	7.475	0.0223	0.1	0.1892
35	A	24-Jan-02	8	7.425	0.0238	0.11	0.2024
36	A	17-Jan-02	8	7.517	0.0177	0.08	0.1507
36	A	22-Jan-02	8	7.508	0.0198	0.09	0.1684
36	A	24-Jan-02	8	7.408	0.0192	0.09	0.163
37	A	22-Jan-02	7	7.508	0.0187	0.08	0.1585
37	A	10-Jan-02	7	7.467	0.0204	0.09	0.1734
37	A	24-Jan-02	7	7.425	0.0181	0.09	0.1542
38	A	22-Jan-02	7	7.433	0.0209	0.08	0.1775
38	A	10-Jan-02	7	7.383	0.022	0.09	0.1871
38	A	24-Jan-02	7	7.358	0.022	0.09	0.1867
39	A	17-Jan-02	7	7.417	0.0234	0.09	0.1987
39	A	22-Jan-02	7	7.408	0.0279	0.1	0.2366
39	A	24-Jan-02	7	7.358	0.0183	0.08	0.1558
40	A	17-Jan-02	8	7.392	0.0212	0.08	0.1798
40	A	22-Jan-02	8	7.383	0.0208	0.08	0.1764
40*	A	24-Jan-02	8	7.8	0.0016	0.01	0.0134
41	A	22-Jan-02	8	7.383	0.0235	0.09	0.1994
41	A	10-Jan-02	8	7.383	0.0231	0.08	0.196
41*	A	24-Jan-02	8	7.8	0.0016	0.01	0.0135
42	A	17-Jan-02	8	7.392	0.0239	0.09	0.2026
42	A	22-Jan-02	8	7.375	0.0257	0.09	0.2179
42	A	24-Jan-02	8	N/D	N/D	N/D	N/D
43	A	22-Jan-02	9	7.392	0.0276	0.1	0.2341
43	A	10-Jan-02	9	7.383	0.0249	0.1	0.2117
43	A	14-Jan-02	9	7.425	0.01	0.04	0.0852
44	A	22-Jan-02	9	7.375	0.0222	0.08	0.1887

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
44	A	10-Jan-02	9	7.367	0.0217	0.08	0.1839
44	A	14-Jan-02	9	7.358	0.0193	0.06	0.1641
45	A	22-Jan-02	9	7.383	0.0188	0.07	0.1595
45	A	10-Jan-02	9	7.375	0.0167	0.07	0.1422
45	A	24-Jan-02	9	7.35	0.0216	0.08	0.1833
46	A	17-Jan-02	10	7.4	0.0237	0.09	0.2014
46	A	22-Jan-02	10	7.367	0.0262	0.09	0.2226
46	A	24-Jan-02	10	7.358	0.0162	0.07	0.138
47	A	17-Jan-02	10	7.392	0.022	0.09	0.1868
47	A	22-Jan-02	10	7.35	0.0239	0.09	0.2032
47	A	24-Jan-02	10	7.35	0.0188	0.08	0.1593
48	A	22-Jan-02	10	7.383	0.0172	0.07	0.1459
48	A	10-Jan-02	10	7.383	0.0208	0.07	0.1763
48	A	14-Jan-02	10	7.433	0.0069	0.03	0.0584
49	A	22-Jan-02	11	7.367	0.0243	0.09	0.2062
49	A	10-Jan-02	11	7.367	0.0224	0.09	0.1901
49	A	24-Jan-02	11	15.483	5.4205	39.6	N/D
50	A	22-Jan-02	11	7.375	0.0199	0.08	0.1693
50	A	10-Jan-02	11	7.35	0.0194	0.07	0.1646
50	A	24-Jan-02	11	15.558	18.0111	117.25	N/D
51	A	22-Jan-02	11	7.367	0.0249	0.09	0.2115
51	A	10-Jan-02	11	7.35	0.0215	0.08	0.183
51	A	24-Jan-02	11	15.475	4.5348	33.18	N/D
52	A	17-Jan-02	12	7.45	0.0238	0.11	0.202
52	A	22-Jan-02	12	7.425	0.0251	0.11	0.2134
52	A	24-Jan-02	12	15.492	5.2949	38.84	N/D
53	A	17-Jan-02	12	7.467	0.0233	0.1	0.1977
53	A	22-Jan-02	12	7.45	0.0222	0.1	0.1882
53	A	24-Jan-02	12	15.492	5.2424	38.47	N/D
54	A	22-Jan-02	12	N/D	N/D	N/D	N/D
54	A	10-Jan-02	12	N/D	N/D	N/D	N/D
54	A	24-Jan-02	12	15.475	3.9904	29.2	N/D
55	A	22-Jan-02	13	7.375	0.0229	0.09	0.1946
55	A	10-Jan-02	13	7.35	0.0217	0.09	0.1843
55	A	24-Jan-02	13	15.475	5.0282	36.71	N/D
56	A	17-Jan-02	13	7.383	0.0129	0.05	0.1094
56	A	22-Jan-02	13	N/D	N/D	N/D	N/D
56	A	24-Jan-02	13	15.592	25.6648	154.55	N/D
57	A	22-Jan-02	13	7.375	0.0197	0.08	0.1677
57	A	10-Jan-02	13	N/D	N/D	N/D	N/D
57	A	24-Jan-02	13	15.492	5.6389	41.06	N/D
58	A	22-Jan-02	12	7.392	0.0242	0.1	0.2056
58	A	10-Jan-02	12	7.358	0.0215	0.1	0.1825
58	A	24-Jan-02	12	15.483	5.4249	39.62	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
59	A	22-Jan-02	12	7.358	0.0195	0.07	0.1655
59	A	10-Jan-02	12	N/D	N/D	N/D	N/D
59	A	24-Jan-02	12	15.475	3.6379	26.67	N/D
60	A	22-Jan-02	12	7.375	0.0199	0.08	0.169
60	A	10-Jan-02	12	N/D	N/D	N/D	N/D
60	A	14-Jan-02	12	7.4	0.011	0.04	0.0938
61	A	22-Jan-02	13	7.358	0.0145	0.06	0.1233
61	A	10-Jan-02	13	N/D	N/D	N/D	N/D
61	A	14-Jan-02	13	7.392	0.0157	0.05	0.1334
62	A	22-Jan-02	13	7.375	0.0112	0.04	0.0955
62	A	10-Jan-02	13	N/D	N/D	N/D	N/D
62	A	24-Jan-02	13	15.475	5.0882	37.23	N/D
63	A	22-Jan-02	13	7.408	0.025	0.1	0.2126
63	A	10-Jan-02	13	N/D	N/D	N/D	N/D
63	A	14-Jan-02	13	7.358	0.027	0.07	0.2295
64	A	22-Jan-02	14	7.383	0.0195	0.08	0.1656
64	A	10-Jan-02	14	N/D	N/D	N/D	N/D
64	A	24-Jan-02	14	15.475	4.7614	34.86	N/D
65	A	17-Jan-02	14	7.45	0.0191	0.09	0.162
65	A	22-Jan-02	14	7.442	0.0226	0.1	0.1917
65	A	24-Jan-02	14	15.483	5.5158	40.32	N/D
66	A	17-Jan-02	14	7.392	0.0192	0.08	0.1632
66	A	23-Jan-02	14	7.35	0.0256	0.1	0.2172
66	A	24-Jan-02	14	15.475	4.9323	36.1	N/D

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix V: Fluoride, Strata B

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	B	25-Jan-02	1	7.533	0.0209	0.09	0.1777
1	B	17-Jan-02	1	7.417	0.0177	0.08	0.1504
1	B	15-Jan-02	1	7.517	0.021	0.09	0.1785
2	B	25-Jan-02	1	7.417	0.0237	0.09	0.2014
2	B	13-Jan-02	1	7.492	0.0284	0.09	0.241
2	B	15-Jan-02	1	7.425	0.0274	0.09	0.2324
3	B	25-Jan-02	1	7.458	0.0235	0.1	0.1999
3	B	13-Jan-02	1	7.508	0.0255	0.1	0.2163
3	B	15-Jan-02	1	7.5	0.0226	0.1	0.1922
4	B	25-Jan-02	2	7.458	0.0216	0.1	0.1836
4	B	13-Jan-02	2	7.508	0.0239	0.1	0.2031
4	B	15-Jan-02	2	7.525	0.0216	0.1	0.1838
5	B	25-Jan-02	2	7.392	0.0253	0.09	0.2147
5	B	17-Jan-02	2	7.383	0.0229	0.08	0.1949
5	B	15-Jan-02	2	7.433	0.029	0.1	0.2459
6	B	25-Jan-02	2	7.383	0.0215	0.09	0.1825
6	B	13-Jan-02	2	7.45	0.0228	0.09	0.1937
6	B	15-Jan-02	2	7.433	0.023	0.09	0.1956
7	B	25-Jan-02	1	7.408	0.0242	0.09	0.2057
7	B	17-Jan-02	1	7.408	0.0202	0.09	0.1717
7	B	15-Jan-02	1	7.45	0.0215	0.09	0.1824
8	B	25-Jan-02	1	7.383	0.0231	0.09	0.196
8	B	13-Jan-02	1	7.45	0.0245	0.1	0.2077
8	B	15-Jan-02	1	7.442	0.0238	0.09	0.202
9	B	25-Jan-02	1	7.45	0.0252	0.12	0.214
9	B	13-Jan-02	1	7.533	0.027	0.12	0.2296
9	B	15-Jan-02	1	7.508	0.0267	0.12	0.2271
10	B	25-Jan-02	2	7.442	0.0189	0.09	0.1604
10	B	13-Jan-02	2	7.525	0.0203	0.09	0.1727
10	B	15-Jan-02	2	7.5	0.0194	0.09	0.1649
11	B	25-Jan-02	2	7.375	0.0262	0.1	0.2227
11	B	13-Jan-02	2	7.458	0.0232	0.09	0.1973
11	B	15-Jan-02	2	7.425	0.0246	0.1	0.2085
12	B	25-Jan-02	2	7.35	0.0208	0.07	0.1766
12	B	13-Jan-02	2	7.417	0.0215	0.07	0.1827
12	B	15-Jan-02	2	7.4	0.0196	0.07	0.1668
13	B	17-Jan-02	3	N/D	N/D	N/D	N/D
14	B	25-Jan-02	3	N/D	N/D	N/D	N/D
14	B	13-Jan-02	3	7.4	0.0185	0.07	0.157
14	B	15-Jan-02	3	7.4	0.0202	0.08	0.1715
15	B	25-Jan-02	3	N/D	N/D	N/D	N/D
15	B	13-Jan-02	3	7.4	0.0193	0.07	0.1638
15	B	15-Jan-02	3	7.383	0.019	0.07	0.1616

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
16	B	25-Jan-02	4	7.383	0.02	0.08	0.1695
16	B	13-Jan-02	4	7.45	0.0207	0.08	0.1756
16	B	15-Jan-02	4	7.442	0.0199	0.09	0.1689
17	B	25-Jan-02	4	N/D	N/D	N/D	N/D
17	B	17-Jan-02	4	N/D	N/D	N/D	N/D
17	B	15-Jan-02	4	7.4	0.022	0.08	0.1865
18	B	25-Jan-02	4	N/D	N/D	N/D	N/D
18	B	17-Jan-02	4	N/D	N/D	N/D	N/D
18	B	15-Jan-02	4	7.392	0.024	0.08	0.2036
19	B	25-Jan-02	3	N/D	N/D	N/D	N/D
19	B	17-Jan-02	3	N/D	N/D	N/D	N/D
19	B	16-Jan-02	3	7.408	0.0179	0.07	0.1521
20	B	25-Jan-02	3	7.4	0.0207	0.09	0.1762
20	B	13-Jan-02	3	7.492	0.0198	0.09	0.1682
20	B	15-Jan-02	3	7.492	0.0189	0.09	0.1602
21	B	25-Jan-02	3	7.4	0.0267	0.11	0.2265
21	B	13-Jan-02	3	7.483	0.0273	0.11	0.232
21	B	15-Jan-02	3	7.475	0.0245	0.11	0.2079
22	B	25-Jan-02	4	7.425	0.0181	0.08	0.1537
22	B	13-Jan-02	4	7.5	0.02	0.09	0.1698
22	B	15-Jan-02	4	7.5	0.0179	0.08	0.1521
23	B	25-Jan-02	4	7.383	0.0183	0.08	0.1555
23	B	13-Jan-02	4	7.45	0.0208	0.09	0.1769
23	B	15-Jan-02	4	7.442	0.0207	0.09	0.1756
24	B	25-Jan-02	4	7.367	0.0145	0.06	0.1228
24	B	13-Jan-02	4	7.4	0.0228	0.09	0.1938
24	B	15-Jan-02	4	7.408	0.0198	0.08	0.1682
25	B	25-Jan-02	5	7.375	0.0278	0.1	0.236
25	B	13-Jan-02	5	7.417	0.0289	0.11	0.2451
25	B	15-Jan-02	5	7.408	0.0269	0.1	0.2286
26	B	25-Jan-02	5	7.375	0.0188	0.07	0.1601
26	B	13-Jan-02	5	7.4	0.0271	0.09	0.2305
26	B	15-Jan-02	5	7.383	0.0228	0.09	0.1937
27	B	25-Jan-02	5	7.35	0.0256	0.1	0.2176
27	B	13-Jan-02	5	7.392	0.0316	0.1	0.2683
27	B	15-Jan-02	5	7.375	0.0319	0.1	0.2707
28	B	25-Jan-02	6	7.35	0.0205	0.06	0.1744
28	B	13-Jan-02	6	7.375	0.0285	0.08	0.2422
28	B	15-Jan-02	6	7.375	0.0203	0.08	0.1721
29	B	25-Jan-02	6	7.425	0.0219	0.1	0.1857
29	B	13-Jan-02	6	7.475	0.0226	0.11	0.1917
29	B	15-Jan-02	6	7.467	0.0225	0.11	0.1914
30	B	25-Jan-02	6	7.367	0.0231	0.09	0.196
30	B	13-Jan-02	6	7.4	0.024	0.1	0.2036

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
30	B	15-Jan-02	6	7.417	0.0238	0.1	0.202
31	B	25-Jan-02	5	N/D	N/D	N/D	N/D
31	B	13-Jan-02	5	7.392	0.0216	0.08	0.1834
31	B	15-Jan-02	5	7.392	0.0198	0.08	0.1684
32	B	13-Jan-02	5	7.4	0.0227	0.09	0.1928
32	B	15-Jan-02	5	7.375	0.022	0.09	0.187
32	B	16-Jan-02	5	7.492	0.0224	0.09	0.1899
33	B	25-Jan-02	5	7.408	0.0183	0.09	0.1556
33	B	13-Jan-02	5	7.467	0.0202	0.09	0.1717
33	B	15-Jan-02	5	7.442	0.0194	0.09	0.1647
34	B	16-Jan-02	8	7.433	0.0238	0.09	0.2023
34	B	26-Jan-02	8	7.475	0.0239	0.09	0.2032
34	B	13-Jan-02	8	7.533	0.0248	0.09	0.2109
35	B	16-Jan-02	8	7.5	0.0224	0.1	0.1906
35	B	26-Jan-02	8	7.492	0.0219	0.1	0.1858
35	B	13-Jan-02	8	7.567	0.0224	0.1	0.1905
36	B	16-Jan-02	8	7.433	0.0246	0.1	0.2093
36	B	26-Jan-02	8	7.433	0.0242	0.1	0.2055
36	B	13-Jan-02	8	7.508	0.0247	0.1	0.2097
37	B	26-Jan-02	7	7.408	0.021	0.09	0.1785
37	B	13-Jan-02	7	7.475	0.0264	0.09	0.224
37	B	23-Jan-02	7	7.442	0.025	0.09	0.2124
38	B	16-Jan-02	7	7.408	0.0197	0.08	0.1671
38	B	26-Jan-02	7	7.383	0.0308	0.08	0.2613
38	B	13-Jan-02	7	7.483	0.0239	0.09	0.2031
39	B	16-Jan-02	7	7.392	0.0217	0.08	0.1843
39	B	26-Jan-02	7	7.375	0.0215	0.08	0.1827
39	B	13-Jan-02	7	7.442	0.0214	0.08	0.1819
40	B	16-Jan-02	8	7.383	0.0208	0.08	0.177
40	B	26-Jan-02	8	7.383	0.0252	0.08	0.2141
40	B	13-Jan-02	8	7.442	0.0238	0.08	0.2024
41*	B	16-Jan-02	8	7.4	0.0332	0.09	0.2817
41	B	26-Jan-02	8	7.375	0.0236	0.09	0.2008
41	B	13-Jan-02	8	7.442	0.0279	0.1	0.2368
42	B	16-Jan-02	8	7.408	0.0281	0.1	0.2384
42	B	26-Jan-02	8	7.375	0.0279	0.1	0.237
42	B	13-Jan-02	8	7.433	0.0292	0.1	0.2483
43	B	16-Jan-02	9	7.375	0.0207	0.08	0.1756
43	B	26-Jan-02	9	7.35	0.0233	0.08	0.1983
43	B	13-Jan-02	9	7.417	0.0224	0.08	0.1899
44	B	16-Jan-02	9	7.392	0.0233	0.09	0.1975
44	B	26-Jan-02	9	7.375	0.0235	0.09	0.1996
44	B	13-Jan-02	9	7.442	0.0219	0.09	0.1864
45	B	16-Jan-02	9	7.408	0.0237	0.09	0.2012

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
45	B	26-Jan-02	9	7.375	0.0246	0.09	0.2089
45	B	13-Jan-02	9	7.45	0.0255	0.09	0.2165
46	B	16-Jan-02	10	7.375	0.0236	0.09	0.2008
46	B	26-Jan-02	10	N/D	N/D	N/D	N/D
46	B	13-Jan-02	10	7.425	0.0244	0.09	0.2074
47	B	16-Jan-02	10	7.392	0.0276	0.09	0.2342
47	B	26-Jan-02	10	7.35	0.0257	0.09	0.2182
47	B	13-Jan-02	10	7.408	0.029	0.1	0.2463
48	B	15-Jan-02	10	7.425	0.0214	0.08	0.1814
48	B	16-Jan-02	10	7.417	0.024	0.1	0.2035
48*	B	13-Jan-02	10	7.492	0.0407	0.19	0.3457
49	B	16-Jan-02	11	7.475	0.0244	0.68	0.2074
49	B	26-Jan-02	11	7.358	0.0215	0.07	0.1823
49	B	13-Jan-02	11	7.4	0.0253	0.08	0.2151
50	B	26-Jan-02	11	7.367	0.018	0.07	0.1529
50	B	13-Jan-02	11	7.417	0.0282	0.1	0.2398
50	B	23-Jan-02	11	7.408	0.0262	0.1	0.2226
51	B	16-Jan-02	11	7.4	0.0241	0.1	0.205
51	B	26-Jan-02	11	7.392	0.0214	0.1	0.1821
51	B	13-Jan-02	11	7.458	0.0265	0.1	0.2248
52	B	16-Jan-02	12	7.408	0.0218	0.09	0.185
52	B	26-Jan-02	12	7.4	0.0289	0.12	0.2454
52	B	13-Jan-02	12	7.458	0.0223	0.1	0.1896
53	B	16-Jan-02	12	7.417	0.0272	0.11	0.2312
53	B	26-Jan-02	12	7.408	0.027	0.11	0.2291
53	B	13-Jan-02	12	7.483	0.027	0.12	0.2296
54	B	16-Jan-02	12	7.367	0.0221	0.09	0.1877
54	B	26-Jan-02	12	7.358	0.0236	0.08	0.2006
54	B	13-Jan-02	12	7.408	0.0222	0.09	0.1883
55	B	16-Jan-02	13	7.35	0.0191	0.07	0.1619
55	B	26-Jan-02	13	7.35	0.0204	0.08	0.1732
55	B	13-Jan-02	13	7.4	0.0226	0.09	0.1919
56	B	15-Jan-02	13	7.425	0.0153	0.07	0.1299
56	B	16-Jan-02	13	7.367	0.0173	0.08	0.1466
57	B	16-Jan-02	13	7.417	0.0211	0.09	0.1791
57	B	26-Jan-02	13	7.392	0.0215	0.09	0.183
57	B	13-Jan-02	13	7.433	0.0239	0.1	0.2028
58	B	16-Jan-02	12	7.45	0.023	0.1	0.195
58	B	26-Jan-02	12	7.425	0.0214	0.1	0.1819
58	B	13-Jan-02	12	7.475	0.0225	0.11	0.1912
59	B	16-Jan-02	12	7.375	0.0207	0.08	0.1757
59	B	26-Jan-02	12	7.375	0.0236	0.08	0.2009
59	B	13-Jan-02	12	7.408	0.0276	0.1	0.2344
60	B	16-Jan-02	12	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
60	B	26-Jan-02	12	7.358	0.0147	0.06	0.1252
60	B	13-Jan-02	12	7.367	0.0228	0.08	0.1938
61	B	16-Jan-02	13	7.358	0.0233	0.09	0.1979
61	B	26-Jan-02	13	7.358	0.0179	0.07	0.1517
61	B	13-Jan-02	13	7.358	0.03	0.09	0.2549
62	B	16-Jan-02	13	7.358	0.0207	0.08	0.1754
62	B	26-Jan-02	13	7.358	0.0179	0.07	0.1524
62	B	13-Jan-02	13	7.392	0.0211	0.08	0.1793
63	B	16-Jan-02	13	7.358	0.0186	0.08	0.1578
63	B	26-Jan-02	13	N/D	N/D	N/D	N/D
63	B	13-Jan-02	13	7.392	0.0217	0.08	0.1842
64	B	16-Jan-02	14	7.617	0.0017	0.03	0.0145
64	B	26-Jan-02	14	7.375	0.0192	0.08	0.1634
64	B	13-Jan-02	14	7.408	0.0203	0.08	0.1726
65	B	16-Jan-02	14	7.417	0.017	0.08	0.1444
65	B	26-Jan-02	14	7.383	0.0177	0.08	0.1503
65	B	13-Jan-02	14	7.45	0.0185	0.08	0.1572
66	B	16-Jan-02	14	7.367	0.02	0.08	0.1702
66	B	26-Jan-02	14	7.35	0.0172	0.07	0.1462
66	B	13-Jan-02	14	7.392	0.0219	0.08	0.1857

\*—JMP 4.0 Outlier

N/D—Not Detected



### Appendix W: Fluoride, Strata C

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	C	16-Jan-02	1	7.575	0.0178	0.08	0.1513
1	C	17-Jan-02	1	7.5	0.0175	0.08	0.1483
1	C	26-Jan-02	1	7.533	0.0165	0.08	0.1402
2	C	16-Jan-02	1	7.542	0.0174	0.08	0.1474
2	C	17-Jan-02	1	7.492	0.0171	0.08	0.1452
2	C	26-Jan-02	1	7.508	0.0161	0.08	0.1366
3	C	16-Jan-02	1	7.525	0.0163	0.08	0.1385
3	C	17-Jan-02	1	7.483	0.0178	0.09	0.1511
3	C	26-Jan-02	1	7.5	0.0177	0.08	0.1502
4	C	16-Jan-02	2	7.508	0.0182	0.09	0.1549
4	C	17-Jan-02	2	7.475	0.0178	0.09	0.1513
4	C	26-Jan-02	2	7.492	0.0188	0.08	0.16
5	C	16-Jan-02	2	7.508	0.0186	0.09	0.1583
5	C	17-Jan-02	2	7.467	0.0188	0.09	0.1601
5	C	26-Jan-02	2	7.492	0.0182	0.08	0.1547
7	C	16-Jan-02	1	7.492	0.0178	0.09	0.1511
7	C	26-Jan-02	1	7.475	0.0171	0.08	0.1455
7	C	22-Jan-02	1	7.442	0.0168	0.08	0.1423
8	C	26-Jan-02	1	7.475	0.0186	0.09	0.1577
8	C	23-Jan-02	1	7.483	0.0177	0.09	0.1502
8	C	22-Jan-02	1	7.433	0.0174	0.09	0.1482
9	C	16-Jan-02	1	7.492	0.0253	0.1	0.2151
9	C	26-Jan-02	1	7.475	0.0179	0.09	0.1517
9	C	22-Jan-02	1	7.45	0.0185	0.09	0.1569
10	C	16-Jan-02	2	7.5	0.0188	0.09	0.16
10	C	26-Jan-02	2	7.475	0.0179	0.09	0.152
10*	C	6-Jan-02	2	7.575	0	0	0.0001
11	C	16-Jan-02	2	7.492	0.0173	0.08	0.1474
11	C	26-Jan-02	2	7.475	0.0169	0.08	0.1435
11*	C	6-Jan-02	2	7.775	0.0005	0	0.0042
12	C	16-Jan-02	2	7.492	0.0175	0.08	0.1489
12	C	26-Jan-02	2	7.467	0.0164	0.08	0.1391
12	C	23-Jan-02	2	7.467	0.0169	0.08	0.1437
13	C	16-Jan-02	3	7.5	0.0175	0.08	0.1485
13*	C	10-Jan-02	3	7.475	0.0022	0.01	0.0185
13	C	26-Jan-02	3	7.458	0.0162	0.08	0.1378
14*	C	10-Jan-02	3	7.792	0.0021	0.01	0.0175
14	C	26-Jan-02	3	7.45	0.0178	0.09	0.151
14	C	23-Jan-02	3	7.458	0.0181	0.09	0.154
15	C	10-Jan-02	3	7.433	0.0203	0.1	0.1723
15	C	26-Jan-02	3	7.458	0.017	0.08	0.1447
15	C	23-Jan-02	3	7.458	0.0176	0.09	0.1493

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
16	C	10-Jan-02	4	7.5	0.0192	0.09	0.1634
16	C	26-Jan-02	4	7.458	0.0174	0.08	0.1478
16	C	6-Jan-02	4	7.45	0.0188	0.09	0.1598
17	C	10-Jan-02	4	7.525	0.0187	0.09	0.1586
17	C	26-Jan-02	4	7.467	0.0172	0.08	0.1461
17	C	23-Jan-02	4	7.458	0.0177	0.09	0.1506
18	C	10-Jan-02	4	7.533	0.0178	0.08	0.1509
18	C	26-Jan-02	4	7.467	0.0174	0.08	0.1481
18	C	23-Jan-02	4	7.442	0.0185	0.09	0.1574
19	C	16-Jan-02	3	7.492	0.0172	0.08	0.1464
19	C	10-Jan-02	3	7.533	0.0172	0.08	0.1462
20	C	16-Jan-02	3	7.483	0.0183	0.09	0.1554
20	C	10-Jan-02	3	7.542	0.0195	0.09	0.1657
20	C	26-Jan-02	3	7.558	0.0162	0.08	0.1379
21	C	10-Jan-02	3	7.542	0.02	0.09	0.17
21*	C	26-Jan-02	3	7.533	0.0002	0	0.0018
21	C	6-Jan-02	3	7.517	0.0184	0.09	0.1566
22*	C	5-Jan-02	4	7.683	0	0	0.0003
22	C	10-Jan-02	4	7.533	0.0191	0.09	0.1625
22	C	6-Jan-02	4	7.55	0.0181	0.09	0.154
23*	C	5-Jan-02	4	7.5	0.0012	0.01	0.0106
23	C	10-Jan-02	4	7.542	0.0191	0.09	0.162
23	C	6-Jan-02	4	7.558	0.0187	0.09	0.1591
24*	C	5-Jan-02	4	7.775	0.0032	0.02	0.0272
24	C	10-Jan-02	4	7.533	0.0191	0.09	0.1618
24	C	6-Jan-02	4	7.558	0.0184	0.09	0.1559
25	C	5-Jan-02	5	7.408	0.0185	0.09	0.1569
25	C	10-Jan-02	5	7.542	0.0177	0.08	0.15
25	C	28-Jan-02	5	7.483	0.01	0.05	0.0853
26	C	10-Jan-02	5	7.542	0.0185	0.09	0.1569
26	C	28-Jan-02	5	7.467	0.0192	0.09	0.1633
26	C	23-Jan-02	5	7.433	0.0183	0.09	0.155
27	C	10-Jan-02	5	7.55	0.019	0.09	0.1613
27	C	28-Jan-02	5	7.467	0.0187	0.09	0.1591
27*	C	23-Jan-02	5	7.442	0.0291	0.1	0.2472
28	C	5-Jan-02	6	7.458	0.0198	0.09	0.1679
28	C	10-Jan-02	6	7.542	0.0184	0.09	0.1562
28	C	6-Jan-02	6	7.567	0.0181	0.09	0.1539
29	C	5-Jan-02	6	7.475	0.0232	0.1	0.1971
29	C	10-Jan-02	6	7.533	0.0219	0.1	0.1862
29	C	6-Jan-02	6	7.525	0.0238	0.1	0.2017
30	C	5-Jan-02	6	7.5	0.0181	0.09	0.154
30	C	10-Jan-02	6	7.542	0.0189	0.09	0.1609

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
30	C	6-Jan-02	6	7.55	0.021	0.1	0.1787
31	C	5-Jan-02	5	7.5	0.0187	0.09	0.1587
31	C	10-Jan-02	5	7.533	0.0184	0.09	0.1559
31	C	28-Jan-02	5	7.467	0.019	0.09	0.1616
32	C	10-Jan-02	5	7.533	0.0185	0.09	0.1575
32	C	28-Jan-02	5	7.442	0.0181	0.09	0.1541
32	C	23-Jan-02	5	7.45	0.018	0.09	0.1527
33	C	10-Jan-02	5	7.517	0.0191	0.09	0.1624
33	C	28-Jan-02	5	7.442	0.0182	0.09	0.1547
33	C	23-Jan-02	5	7.458	0.0179	0.09	0.1525
34	C	5-Jan-02	8	7.525	0.0183	0.09	0.1552
34	C	10-Jan-02	8	7.508	0.0187	0.09	0.1587
34	C	6-Jan-02	8	7.55	0.0177	0.08	0.1501
35	C	5-Jan-02	8	7.517	0.0192	0.09	0.1628
35	C	10-Jan-02	8	7.517	0.0192	0.09	0.1635
35	C	6-Jan-02	8	7.542	0.018	0.09	0.1531
36	C	5-Jan-02	8	7.517	0.0187	0.09	0.1589
36	C	10-Jan-02	8	7.533	0.0188	0.09	0.16
36	C	6-Jan-02	8	7.533	0.0186	0.09	0.1577
37	C	5-Jan-02	7	7.508	0.0179	0.08	0.1521
37	C	10-Jan-02	7	7.525	0.0168	0.08	0.1431
37*	C	28-Jan-02	7	7.458	0.0001	0	0.0009
37	C	6-Jan-02	7	7.525	0.0184	0.09	0.1559
38	C	10-Jan-02	7	7.525	0.0196	0.09	0.1667
38	C	28-Jan-02	7	7.442	0.0196	0.09	0.1666
38	C	6-Jan-02	7	7.525	0.0207	0.09	0.1755
39	C	10-Jan-02	7	7.517	0.0198	0.09	0.1682
39	C	28-Jan-02	7	7.45	0.017	0.08	0.1443
39	C	23-Jan-02	7	7.45	0.0174	0.09	0.1477
40	C	10-Jan-02	8	7.517	0.0194	0.09	0.1648
40	C	28-Jan-02	8	7.458	0.0178	0.09	0.151
40	C	23-Jan-02	8	7.45	0.018	0.09	0.153
41	C	10-Jan-02	8	7.508	0.0189	0.09	0.1608
41	C	28-Jan-02	8	7.45	0.0185	0.09	0.1575
41	C	6-Jan-02	8	7.525	0.0181	0.09	0.1537
42	C	10-Jan-02	8	7.508	0.019	0.09	0.1612
42	C	28-Jan-02	8	7.442	0.0174	0.08	0.1475
42	C	23-Jan-02	8	7.45	0.0177	0.09	0.1503
43	C	10-Jan-02	9	7.517	0.0186	0.09	0.1582
43	C	28-Jan-02	9	7.442	0.0163	0.08	0.1384
43	C	6-Jan-02	9	7.517	0.0187	0.09	0.1591
44	C	10-Jan-02	9	7.517	0.0194	0.09	0.1651
44	C	28-Jan-02	9	7.442	0.0177	0.09	0.15
44	C	23-Jan-02	9	7.45	0.0185	0.09	0.1573

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
45	C	10-Jan-02	9	7.525	0.0194	0.09	0.1645
45	C	28-Jan-02	9	7.433	0.0174	0.09	0.1477
45	C	23-Jan-02	9	7.458	0.0194	0.09	0.1645
46	C	28-Jan-02	10	7.442	0.0179	0.09	0.1524
46	C	10-Jan-02	10	7.617	0.0186	0.09	0.1578
46	C	23-Jan-02	10	7.467	0.0176	0.09	0.1495
47	C	28-Jan-02	10	7.45	0.0185	0.08	0.1572
47	C	10-Jan-02	10	7.583	0.018	0.09	0.1526
47	C	23-Jan-02	10	7.467	0.0174	0.08	0.1476
48	C	28-Jan-02	10	7.45	0.0168	0.08	0.1426
48	C	10-Jan-02	10	7.575	0.018	0.09	0.1527
48	C	6-Jan-02	10	7.508	0.0182	0.09	0.1545
49	C	28-Jan-02	11	7.433	0.0204	0.08	0.1735
49	C	10-Jan-02	11	7.567	0.0189	0.08	0.1608
49	C	6-Jan-02	11	7.508	0.0169	0.08	0.1437
50	C	28-Jan-02	11	7.433	0.0177	0.09	0.1504
50	C	10-Jan-02	11	7.567	0.0196	0.09	0.1662
50	C	6-Jan-02	11	7.517	0.018	0.09	0.153
51	C	28-Jan-02	11	7.442	0.0174	0.09	0.1479
51	C	10-Jan-02	11	7.567	0.0198	0.09	0.1678
51	C	6-Jan-02	11	7.525	0.0182	0.09	0.1548
52	C	28-Jan-02	12	7.442	0.0176	0.09	0.1495
52	C	10-Jan-02	12	7.558	0.0201	0.09	0.1708
52	C	23-Jan-02	12	7.458	0.0185	0.09	0.157
53	C	28-Jan-02	12	7.45	0.0222	0.1	0.1882
53	C	10-Jan-02	12	7.55	0.02	0.09	0.1697
53	C	23-Jan-02	12	7.442	0.0186	0.09	0.1581
54	C	28-Jan-02	12	7.442	0.0177	0.09	0.1505
54	C	10-Jan-02	12	7.533	0.0233	0.1	0.1976
54	C	23-Jan-02	12	7.45	0.018	0.09	0.153
55	C	28-Jan-02	13	7.45	0.0173	0.08	0.1471
55	C	10-Jan-02	13	7.533	0.0183	0.09	0.1557
55	C	23-Jan-02	13	7.45	0.0169	0.08	0.1439
56	C	28-Jan-02	13	7.45	0.0172	0.08	0.1457
56	C	10-Jan-02	13	7.525	0.0192	0.09	0.163
56	C	23-Jan-02	13	7.442	0.0181	0.09	0.1537
57	C	28-Jan-02	13	7.45	0.0175	0.09	0.1486
57	C	10-Jan-02	13	7.525	0.0191	0.09	0.1626
57	C	23-Jan-02	13	7.442	0.0185	0.09	0.1571
58	C	28-Jan-02	12	7.442	0.0176	0.09	0.1497
58	C	10-Jan-02	12	7.525	0.0202	0.1	0.1712
58	C	23-Jan-02	12	7.442	0.0188	0.09	0.1599
59	C	28-Jan-02	12	7.442	0.0176	0.08	0.1491
59	C	10-Jan-02	12	7.525	0.0191	0.09	0.1623

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
59	C	23-Jan-02	12	7.417	0.0185	0.09	0.1569
60	C	28-Jan-02	12	7.442	0.0177	0.09	0.1505
60	C	10-Jan-02	12	7.525	0.019	0.09	0.1614
60	C	6-Jan-02	12	7.5	0.0203	0.1	0.1722
61	C	28-Jan-02	13	7.433	0.0162	0.08	0.1377
61	C	10-Jan-02	13	7.542	0.0185	0.09	0.157
61	C	23-Jan-02	13	7.417	0.0183	0.09	0.1555
62	C	28-Jan-02	13	7.442	0.018	0.09	0.1531
62	C	10-Jan-02	13	7.542	0.0194	0.09	0.1644
62	C	23-Jan-02	13	7.433	0.0181	0.09	0.1538
63	C	28-Jan-02	13	7.433	0.0176	0.08	0.1493
63	C	10-Jan-02	13	7.533	0.0181	0.09	0.1538
63	C	23-Jan-02	13	7.433	0.0176	0.09	0.1499
64	C	28-Jan-02	14	7.433	0.0183	0.09	0.1555
64	C	10-Jan-02	14	7.533	0.0191	0.09	0.1624
64	C	23-Jan-02	14	7.442	0.019	0.09	0.1612
65	C	28-Jan-02	14	7.45	0.0151	0.08	0.1283
65	C	10-Jan-02	14	7.525	0.019	0.09	0.1612
65	C	23-Jan-02	14	7.433	0.0186	0.09	0.1576
66	C	28-Jan-02	14	7.433	0.0179	0.08	0.1519
66	C	10-Jan-02	14	7.517	0.0187	0.09	0.1592
66	C	23-Jan-02	14	7.45	0.0185	0.09	0.1572

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix X: Fluoride, Field Blanks, Influent and Effluent

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
Blank	BLANK	10-Jan-02	B	N/D	N/D	N/D	N/D
Blank	BLANK	26-Jan-02	B	7.483	0.0001	0	0.0011
Blank	BLANK	28-Jan-02	B	7.45	0.0001	0	0.001
Influent	INFLUENT	5-Jan-02	I	7.508	0.0187	0.09	0.1586
Influent	INFLUENT	10-Jan-02	I	7.517	0.0193	0.09	0.1639
Influent	INFLUENT	6-Jan-02	I	7.5	0.0181	0.09	0.1542
Effluent	EFFLUENT	5-Jan-02	E	7.517	0.0189	0.09	0.1607
Effluent	EFFLUENT	10-Jan-02	E	7.525	0.0189	0.09	0.1606
Effluent	EFFLUENT	6-Jan-02	E	7.5	0.0187	0.09	0.1592

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix Y: Formate, Strata A

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	A	16-Jan-02	1	11.308	0.004	0.01	0.0835
1	A	17-Jan-02	1	11.25	0.0061	0.01	0.1256
1	A	23-Jan-02	1	11.317	0.0031	0.01	0.0649
2	A	16-Jan-02	1	11.283	0.0066	0.02	0.1372
2	A	17-Jan-02	1	11.233	0.0077	0.02	0.1599
2	A	23-Jan-02	1	11.267	0.0082	0.02	0.1687
3	A	18-Jan-02	1	11.2	0.0116	0.04	0.2403
3	A	16-Jan-02	1	11.217	0.0122	0.04	0.2513
3	A	17-Jan-02	1	11.192	0.012	0.04	0.2479
4	A	18-Jan-02	2	11.233	0.0054	0.02	0.1118
4	A	16-Jan-02	2	11.242	0.0046	0.02	0.0957
4	A	17-Jan-02	2	11.208	0.0067	0.02	0.1386
5	A	18-Jan-02	2	11.208	0.0126	0.04	0.2596
5	A	16-Jan-02	2	11.225	0.0071	0.03	0.1462
5	A	17-Jan-02	2	11.192	0.0081	0.03	0.1669
6	A	18-Jan-02	2	11.217	0.0058	0.02	0.1192
6	A	16-Jan-02	2	11.25	0.0077	0.02	0.1591
6	A	17-Jan-02	2	11.208	0.0053	0.02	0.1099
7	A	17-Jan-02	1	11.217	0.0069	0.03	0.1423
7	A	23-Jan-02	1	11.242	0.0091	0.03	0.1889
8	A	18-Jan-02	1	11.208	0.0089	0.03	0.1845
8	A	16-Jan-02	1	11.242	0.004	0.01	0.0818
8	A	17-Jan-02	1	11.208	0.0047	0.02	0.098
9	A	18-Jan-02	1	11.225	0.0085	0.03	0.1763
9	A	16-Jan-02	1	11.233	0.0085	0.02	0.1763
9	A	17-Jan-02	1	11.233	0.0045	0.01	0.0938
10	A	18-Jan-02	2	11.258	0.0006	0	0.0125
10	A	10-Jan-02	2	N/D	N/D	N/D	N/D
10	A	16-Jan-02	2	N/D	N/D	N/D	N/D
10	A	14-Jan-02	2	11.367	0.003	0.01	0.0616
11	A	18-Jan-02	2	11.208	0.0133	0.05	0.2752
11	A	10-Jan-02	2	11.15	0.0151	0.04	0.3125
11	A	16-Jan-02	2	11.225	0.0114	0.04	0.236
11	A	14-Jan-02	2	11.283	0.0143	0.04	0.2944
12	A	18-Jan-02	2	11.208	0.0081	0.03	0.167
12	A	10-Jan-02	2	11.25	0.0114	0.03	0.236
12	A	16-Jan-02	2	11.217	0.0081	0.02	0.1663
13	A	18-Jan-02	3	11.208	0.0116	0.04	0.2394
13	A	16-Jan-02	3	11.2	0.0071	0.03	0.1476
13	A	17-Jan-02	3	11.192	0.0095	0.04	0.1969
14	A	18-Jan-02	3	11.2	0.0124	0.04	0.2567
14	A	23-Jan-02	3	11.2	0.0124	0.04	0.2569
14	A	14-Jan-02	3	11.275	0.013	0.04	0.2693

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
15	A	18-Jan-02	3	11.2	0.0123	0.04	0.2538
15	A	17-Jan-02	3	11.217	0.0093	0.03	0.1911
15	A	23-Jan-02	3	11.217	0.0103	0.03	0.2133
16	A	18-Jan-02	4	N/D	N/D	N/D	N/D
16	A	10-Jan-02	4	11.342	0.0004	0	0.009
16	A	23-Jan-02	4	11.258	0.0003	0	0.0054
17	A	17-Jan-02	4	11.192	0.0124	0.04	0.2558
17	A	18-Jan-02	4	11.308	0.0083	0.03	0.1719
17	A	23-Jan-02	4	11.2	0.012	0.04	0.2473
18	A	18-Jan-02	4	11.308	0.0088	0.02	0.1818
18	A	23-Jan-02	4	11.217	0.0058	0.02	0.1191
18	A	14-Jan-02	4	11.3	0.0042	0.01	0.0862
19	A	17-Jan-02	3	11.2	0.0086	0.04	0.1777
19	A	18-Jan-02	3	11.242	0.0119	0.04	0.2458
19	A	24-Jan-02	3	11.183	0.012	0.04	0.2469
20	A	10-Jan-02	3	11.308	0.0092	0.03	0.1897
20	A	18-Jan-02	3	11.283	0.0025	0.01	0.0513
20	A	23-Jan-02	3	11.25	0.0044	0.02	0.0913
21	A	10-Jan-02	3	11.308	0.0107	0.03	0.2202
21	A	18-Jan-02	3	11.267	0.0043	0.02	0.0888
21	A	23-Jan-02	3	11.233	0.0049	0.02	0.1016
22	A	10-Jan-02	4	11.325	0.0037	0.01	0.0764
22	A	18-Jan-02	4	11.275	0.0027	0.01	0.0566
22	A	23-Jan-02	4	11.25	0.0055	0.01	0.113
23	A	10-Jan-02	4	11.275	0.013	0.04	0.269
23	A	18-Jan-02	4	11.208	0.0134	0.04	0.2763
23	A	14-Jan-02	4	11.275	0.0097	0.03	0.2003
24	A	10-Jan-02	4	11.275	0.0154	0.05	0.3178
24	A	18-Jan-02	4	11.225	0.0123	0.04	0.2543
24	A	14-Jan-02	4	11.25	0.008	0.03	0.1645
25	A	10-Jan-02	5	11.3	0.0047	0.02	0.0976
25	A	18-Jan-02	5	11.25	0.0042	0.01	0.0873
25	A	23-Jan-02	5	11.242	0.0039	0.01	0.081
26	A	17-Jan-02	5	11.192	0.011	0.04	0.2262
26	A	18-Jan-02	5	11.217	0.0077	0.03	0.1599
26	A	23-Jan-02	5	11.2	0.0084	0.03	0.1745
27	A	18-Jan-02	5	11.225	0.0095	0.04	0.1969
27	A	23-Jan-02	5	11.208	0.0105	0.04	0.2165
27	A	14-Jan-02	5	11.258	0.0125	0.05	0.2574
28	A	10-Jan-02	6	11.267	0.0145	0.04	0.3002
28	A	18-Jan-02	6	11.2	0.0157	0.05	0.3236
28	A	23-Jan-02	6	11.192	0.0114	0.04	0.2348
29	A	10-Jan-02	6	N/D	N/D	N/D	N/D
29	A	18-Jan-02	6	11.275	0.0025	0.01	0.0508



Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
29	A	23-Jan-02	6	N/D	N/D	N/D	N/D
30	A	10-Jan-02	6	N/D	N/D	N/D	N/D
30	A	18-Jan-02	6	N/D	N/D	N/D	N/D
30	A	24-Jan-02	6	N/D	N/D	N/D	N/D
31	A	10-Jan-02	5	11.233	0.0095	0.04	0.1966
31	A	18-Jan-02	5	11.208	0.0113	0.05	0.2332
31	A	14-Jan-02	5	11.258	0.0073	0.03	0.15
32	A	17-Jan-02	5	11.3	0.0015	0.01	0.0313
32	A	18-Jan-02	5	11.217	0.0056	0.02	0.1151
32	A	23-Jan-02	5	11.2	0.0088	0.03	0.1811
33	A	18-Jan-02	5	11.233	0.0073	0.02	0.151
33	A	23-Jan-02	5	11.225	0.0044	0.02	0.0902
33	A	14-Jan-02	5	11.267	0.0048	0.02	0.0988
34	A	22-Jan-02	8	11.308	0.0063	0.03	0.1305
34	A	10-Jan-02	8	11.267	0.006	0.02	0.1239
34	A	24-Jan-02	8	11.208	0.01	0.03	0.2071
35	A	22-Jan-02	8	11.3	0.008	0.02	0.1653
35	A	10-Jan-02	8	11.283	0.0068	0.02	0.1398
35	A	24-Jan-02	8	11.233	0.0038	0.01	0.0794
36	A	17-Jan-02	8	11.325	0.0066	0.01	0.1364
36	A	22-Jan-02	8	11.292	0.0031	0.01	0.0634
36	A	24-Jan-02	8	11.233	0.0057	0.01	0.1185
37	A	22-Jan-02	7	11.283	0.0066	0.02	0.1354
37	A	10-Jan-02	7	11.275	0.0072	0.02	0.1487
37	A	24-Jan-02	7	11.233	0.0051	0.01	0.1045
38	A	22-Jan-02	7	11.258	0.0075	0.03	0.1551
38	A	10-Jan-02	7	11.233	0.0074	0.03	0.1522
38	A	24-Jan-02	7	11.2	0.0055	0.02	0.1129
39	A	17-Jan-02	7	11.25	0.0124	0.04	0.2557
39	A	22-Jan-02	7	11.25	0.0074	0.03	0.1538
39	A	24-Jan-02	7	11.2	0.0068	0.03	0.1399
40	A	17-Jan-02	8	11.233	0.0122	0.03	0.252
40	A	22-Jan-02	8	11.233	0.0081	0.03	0.1665
40	A	24-Jan-02	8	11.175	0.0118	0.04	0.2437
41	A	22-Jan-02	8	11.225	0.0122	0.04	0.2525
41	A	10-Jan-02	8	11.233	0.0073	0.03	0.15
41	A	24-Jan-02	8	11.175	0.0096	0.04	0.1991
42	A	17-Jan-02	8	11.233	0.0084	0.03	0.1741
42	A	22-Jan-02	8	11.217	0.0073	0.03	0.15
42	A	24-Jan-02	8	11.183	0.0093	0.04	0.1916
43	A	22-Jan-02	9	11.225	0.0102	0.03	0.2099
43	A	10-Jan-02	9	11.233	0.0037	0.02	0.0755
43	A	14-Jan-02	9	11.25	0.0089	0.02	0.1842
44	A	22-Jan-02	9	11.225	0.0127	0.04	0.2633

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
44	A	10-Jan-02	9	11.217	0.0087	0.04	0.179
44	A	14-Jan-02	9	11.208	0.014	0.04	0.2896
45	A	22-Jan-02	9	11.225	0.0047	0.01	0.0966
45	A	10-Jan-02	9	11.242	0.0057	0.02	0.1182
45	A	24-Jan-02	9	11.208	0.0061	0.02	0.1252
46	A	17-Jan-02	10	11.242	0.0098	0.02	0.2017
46	A	22-Jan-02	10	11.208	0.0083	0.03	0.171
46	A	24-Jan-02	10	11.192	0.0095	0.03	0.1955
47	A	17-Jan-02	10	11.233	0.0077	0.02	0.1592
47	A	22-Jan-02	10	11.2	0.0125	0.04	0.2574
47	A	24-Jan-02	10	11.192	0.0104	0.04	0.2145
48	A	22-Jan-02	10	11.242	0.0062	0.02	0.1278
48	A	10-Jan-02	10	11.233	0.0065	0.02	0.1332
48	A	14-Jan-02	10	11.283	0.0032	0.01	0.0661
49	A	22-Jan-02	11	11.217	0.0097	0.04	0.2001
49	A	10-Jan-02	11	11.217	0.0086	0.03	0.178
49	A	24-Jan-02	11	N/D	N/D	N/D	N/D
50	A	22-Jan-02	11	11.208	0.0095	0.04	0.197
50	A	10-Jan-02	11	11.208	0.0055	0.03	0.1142
50	A	24-Jan-02	11	N/D	N/D	N/D	N/D
51	A	22-Jan-02	11	11.208	0.0095	0.04	0.1965
51	A	10-Jan-02	11	11.208	0.0069	0.03	0.142
51	A	24-Jan-02	11	N/D	N/D	N/D	N/D
52	A	17-Jan-02	12	11.258	0.0057	0.02	0.1183
52	A	22-Jan-02	12	11.242	0.0089	0.03	0.1837
52	A	24-Jan-02	12	N/D	N/D	N/D	N/D
53	A	17-Jan-02	12	11.258	0.0095	0.03	0.1963
53	A	22-Jan-02	12	11.25	0.0062	0.03	0.1283
53	A	24-Jan-02	12	N/D	N/D	N/D	N/D
54	A	22-Jan-02	12	11.192	0.0167	0.08	0.344
54	A	10-Jan-02	12	11.2	0.0228	0.11	0.4712
54	A	24-Jan-02	12	N/D	N/D	N/D	N/D
55	A	22-Jan-02	13	11.208	0.0129	0.05	0.2659
55	A	10-Jan-02	13	11.192	0.0126	0.06	0.2601
55	A	24-Jan-02	13	N/D	N/D	N/D	N/D
56	A	17-Jan-02	13	11.225	0.0085	0.02	0.176
56	A	22-Jan-02	13	11.192	0.0061	0.02	0.1269
56	A	24-Jan-02	13	N/D	N/D	N/D	N/D
57	A	22-Jan-02	13	11.2	0.0089	0.04	0.1838
57	A	10-Jan-02	13	11.192	0.0077	0.04	0.1586
57	A	24-Jan-02	13	N/D	N/D	N/D	N/D
58	A	22-Jan-02	12	11.217	0.0119	0.05	0.2458
58	A	10-Jan-02	12	11.2	0.0128	0.07	0.265
58	A	24-Jan-02	12	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
59	A	22-Jan-02	12	11.2	0.0083	0.05	0.1704
59	A	10-Jan-02	12	11.183	0.0107	0.05	0.222
59	A	24-Jan-02	12	N/D	N/D	N/D	N/D
60	A	22-Jan-02	12	11.208	0.01	0.06	0.2056
60	A	10-Jan-02	12	11.175	0.0142	0.08	0.2941
60*	A	14-Jan-02	12	11.217	0.0288	0.14	0.5952
61	A	22-Jan-02	13	11.2	0.0177	0.08	0.3664
61	A	10-Jan-02	13	11.183	0.0234	0.11	0.4823
61	A	14-Jan-02	13	11.217	0.0147	0.08	0.3042
62	A	22-Jan-02	13	11.208	0.018	0.09	0.372
62	A	10-Jan-02	13	11.175	0.0242	0.12	0.4989
62	A	24-Jan-02	13	N/D	N/D	N/D	N/D
63*	A	22-Jan-02	13	11.225	0.0458	0.29	0.9459
63*	A	10-Jan-02	13	11.175	0.0545	0.31	1.1249
63	A	14-Jan-02	13	11.208	0.0272	0.14	0.5621
64	A	22-Jan-02	14	11.217	0.0147	0.06	0.3036
64	A	10-Jan-02	14	11.175	0.0166	0.07	0.3435
64	A	24-Jan-02	14	N/D	N/D	N/D	N/D
65	A	17-Jan-02	14	11.242	0.0085	0.03	0.1761
65	A	22-Jan-02	14	11.242	0.0058	0.02	0.1205
65	A	24-Jan-02	14	N/D	N/D	N/D	N/D
66*	A	17-Jan-02	14	11.217	0.0499	0.27	1.0306
66	A	23-Jan-02	14	11.192	0.0241	0.11	0.4982
66	A	24-Jan-02	14	N/D	N/D	N/D	N/D

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix Z: Formate, Strata B

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	B	25-Jan-02	1	11.292	0.0031	0.02	0.0575
1	B	17-Jan-02	1	11.208	0.0067	0.02	0.1253
1	B	15-Jan-02	1	11.292	0.0149	0.05	0.281
2	B	25-Jan-02	1	11.25	0.0083	0.03	0.1556
2	B	13-Jan-02	1	11.333	0.0204	0.04	0.3832
2	B	15-Jan-02	1	11.267	0.0153	0.05	0.2873
3	B	25-Jan-02	1	11.25	0.0034	0.02	0.0641
3	B	13-Jan-02	1	11.317	0.0133	0.03	0.2504
3	B	15-Jan-02	1	11.3	0.0112	0.03	0.2105
4	B	25-Jan-02	2	11.25	0.0024	0.01	0.0454
4	B	13-Jan-02	2	11.317	0.013	0.03	0.2454
4	B	15-Jan-02	2	11.317	0.0065	0.02	0.1219
5	B	25-Jan-02	2	11.225	0.0089	0.04	0.1681
5	B	17-Jan-02	2	11.208	0.0141	0.05	0.2664
5	B	15-Jan-02	2	11.267	0.0181	0.05	0.341
6	B	25-Jan-02	2	11.208	0.0075	0.03	0.141
6	B	13-Jan-02	2	11.283	0.0168	0.04	0.3159
6	B	15-Jan-02	2	11.267	0.0137	0.04	0.2577
7	B	25-Jan-02	1	11.225	0.0065	0.03	0.1216
7	B	17-Jan-02	1	11.225	0.0117	0.04	0.2207
7	B	15-Jan-02	1	11.267	0.0154	0.05	0.2893
8	B	25-Jan-02	1	11.208	0.0107	0.04	0.2019
8	B	13-Jan-02	1	11.292	0.0165	0.04	0.3099
8	B	15-Jan-02	1	11.275	0.0137	0.04	0.2576
9	B	25-Jan-02	1	11.233	0.0037	0.02	0.0699
9	B	13-Jan-02	1	11.333	0.0007	0	0.0138
9	B	15-Jan-02	1	11.292	0.0086	0.02	0.1625
10	B	25-Jan-02	2	N/D	N/D	N/D	N/D
10	B	13-Jan-02	2	N/D	N/D	N/D	N/D
10	B	15-Jan-02	2	N/D	N/D	N/D	N/D
11	B	25-Jan-02	2	11.2	0.0112	0.04	0.2114
11	B	13-Jan-02	2	11.292	0.0152	0.04	0.2864
11	B	15-Jan-02	2	11.258	0.0143	0.04	0.269
12	B	25-Jan-02	2	11.192	0.0125	0.04	0.2354
12	B	13-Jan-02	2	11.267	0.0146	0.04	0.2749
12	B	15-Jan-02	2	11.242	0.0173	0.05	0.3257
13	B	17-Jan-02	3	11.192	0.0111	0.04	0.2097
14	B	25-Jan-02	3	11.192	0.0078	0.03	0.1473
14	B	13-Jan-02	3	11.258	0.0173	0.05	0.3258
14	B	15-Jan-02	3	11.25	0.0151	0.04	0.2844
15	B	25-Jan-02	3	11.192	0.0082	0.03	0.1544
15	B	13-Jan-02	3	11.25	0.0172	0.04	0.3234
15	B	15-Jan-02	3	11.233	0.011	0.04	0.2075

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
16	B	25-Jan-02	4	11.208	0.0062	0.03	0.1164
16	B	13-Jan-02	4	11.275	0.0138	0.04	0.2593
16	B	15-Jan-02	4	11.258	0.0078	0.03	0.1469
17	B	25-Jan-02	4	11.183	0.0093	0.04	0.1749
17	B	17-Jan-02	4	11.183	0.0146	0.05	0.2749
17	B	15-Jan-02	4	11.242	0.0163	0.05	0.3061
18	B	25-Jan-02	4	11.183	0.0153	0.06	0.2875
18	B	17-Jan-02	4	11.175	0.0131	0.05	0.2473
18	B	15-Jan-02	4	11.242	0.0178	0.06	0.3351
19	B	25-Jan-02	3	11.183	0.0163	0.06	0.3078
19	B	17-Jan-02	3	11.183	0.018	0.06	0.3386
19	B	16-Jan-02	3	11.242	0.0109	0.03	0.206
20	B	25-Jan-02	3	11.225	0.0022	0.01	0.0415
20	B	13-Jan-02	3	N/D	N/D	N/D	N/D
20	B	15-Jan-02	3	11.3	0.0044	0.01	0.0835
21	B	25-Jan-02	3	11.217	0.0081	0.03	0.152
21	B	13-Jan-02	3	11.292	0.0136	0.03	0.2557
21	B	15-Jan-02	3	11.275	0.0125	0.04	0.2347
22	B	25-Jan-02	4	11.25	0.0021	0.01	0.0392
22	B	13-Jan-02	4	N/D	N/D	N/D	N/D
22	B	15-Jan-02	4	11.3	0.0065	0.02	0.1215
23	B	25-Jan-02	4	11.208	0.0129	0.05	0.2437
23	B	13-Jan-02	4	11.283	0.0137	0.04	0.2581
23	B	15-Jan-02	4	11.267	0.0124	0.04	0.2335
24	B	25-Jan-02	4	11.208	0.0068	0.04	0.1274
24	B	13-Jan-02	4	11.25	0.0196	0.06	0.3681
24	B	15-Jan-02	4	11.242	0.018	0.07	0.3382
25	B	25-Jan-02	5	11.208	0.0131	0.05	0.2469
25	B	13-Jan-02	5	11.25	0.0182	0.06	0.3427
25	B	15-Jan-02	5	11.242	0.0159	0.07	0.2993
26	B	25-Jan-02	5	11.2	0.008	0.03	0.1503
26	B	13-Jan-02	5	11.25	0.0147	0.04	0.2768
26	B	15-Jan-02	5	11.233	0.0112	0.03	0.2117
27	B	25-Jan-02	5	11.183	0.0109	0.05	0.206
27	B	13-Jan-02	5	11.233	0.0177	0.05	0.3328
27	B	15-Jan-02	5	11.217	0.0161	0.05	0.3027
28	B	25-Jan-02	6	11.192	0.0095	0.04	0.1797
28	B	13-Jan-02	6	11.233	0.0165	0.05	0.3103
28	B	15-Jan-02	6	11.225	0.0106	0.04	0.1999
29	B	25-Jan-02	6	11.25	0.0015	0.01	0.0287
29	B	13-Jan-02	6	11.283	0.0055	0.01	0.1038
29	B	15-Jan-02	6	11.275	0.0067	0.02	0.1268
30	B	25-Jan-02	6	11.2	0.0112	0.04	0.2113
30	B	13-Jan-02	6	11.242	0.0148	0.04	0.2782

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
30	B	15-Jan-02	6	11.242	0.0144	0.05	0.2715
31	B	25-Jan-02	5	11.175	0.0124	0.06	0.2333
31	B	13-Jan-02	5	11.233	0.0162	0.05	0.305
31	B	15-Jan-02	5	11.225	0.0079	0.05	0.1479
32	B	13-Jan-02	5	11.242	0.0162	0.05	0.3045
32	B	15-Jan-02	5	11.225	0.0134	0.04	0.2518
32	B	16-Jan-02	5	11.317	0.0151	0.04	0.2843
33	B	25-Jan-02	5	11.217	0.0044	0.02	0.0834
33	B	13-Jan-02	5	11.267	0.0115	0.03	0.2167
33	B	15-Jan-02	5	11.25	0.0095	0.03	0.1782
34	B	16-Jan-02	8	11.283	0.0139	0.04	0.2609
34	B	26-Jan-02	8	11.283	0.0115	0.03	0.2167
34	B	13-Jan-02	8	11.342	0.0217	0.05	0.4089
35	B	16-Jan-02	8	11.308	0.0093	0.02	0.1759
35	B	26-Jan-02	8	11.275	0.0068	0.02	0.1276
35	B	13-Jan-02	8	11.342	0.0138	0.03	0.2589
36	B	16-Jan-02	8	11.258	0.0163	0.05	0.3074
36	B	26-Jan-02	8	11.25	0.0056	0.02	0.1051
36	B	13-Jan-02	8	11.308	0.0184	0.05	0.3457
37	B	26-Jan-02	7	11.225	0.0064	0.03	0.12
37	B	13-Jan-02	7	11.292	0.0198	0.05	0.3736
37	B	23-Jan-02	7	11.258	0.0068	0.03	0.1281
38	B	16-Jan-02	7	11.25	0.0149	0.04	0.2811
38	B	26-Jan-02	7	11.217	0.0077	0.03	0.1458
38	B	13-Jan-02	7	11.3	0.0204	0.06	0.3846
39	B	16-Jan-02	7	11.242	0.0145	0.04	0.2728
39	B	26-Jan-02	7	11.208	0.009	0.04	0.17
39	B	13-Jan-02	7	11.275	0.0224	0.06	0.4222
40	B	16-Jan-02	8	11.225	0.0229	0.09	0.4313
40*	B	26-Jan-02	8	11.217	0.0311	0.15	0.5858
40*	B	13-Jan-02	8	11.275	0.043	0.19	0.81
41	B	16-Jan-02	8	11.242	0.0156	0.04	0.294
41	B	26-Jan-02	8	11.208	0.0091	0.04	0.1718
41	B	13-Jan-02	8	11.275	0.0218	0.06	0.4113
42	B	16-Jan-02	8	11.25	0.0122	0.03	0.229
42	B	26-Jan-02	8	11.2	0.0113	0.04	0.2135
42	B	13-Jan-02	8	11.267	0.0201	0.06	0.3792
43	B	16-Jan-02	9	11.233	0.0156	0.04	0.2944
43	B	26-Jan-02	9	11.192	0.0075	0.04	0.1405
43	B	13-Jan-02	9	11.25	0.0224	0.07	0.4227
44	B	16-Jan-02	9	11.242	0.0117	0.03	0.2195
44	B	26-Jan-02	9	11.208	0.0062	0.02	0.1164
44	B	13-Jan-02	9	11.267	0.0184	0.05	0.3467
45	B	16-Jan-02	9	11.25	0.0109	0.03	0.2054

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
45	B	26-Jan-02	9	11.208	0.0093	0.03	0.1752
45	B	13-Jan-02	9	11.275	0.0171	0.05	0.322
46	B	16-Jan-02	10	11.233	0.0155	0.04	0.2916
46	B	26-Jan-02	10	11.192	0.0139	0.05	0.2617
46	B	13-Jan-02	10	11.258	0.0215	0.07	0.4056
47	B	16-Jan-02	10	11.242	0.0129	0.03	0.2433
47	B	26-Jan-02	10	11.192	0.0076	0.03	0.1431
47	B	13-Jan-02	10	11.25	0.0182	0.05	0.3426
48	B	15-Jan-02	10	N/D	N/D	N/D	N/D
48	B	16-Jan-02	10	11.258	0.0092	0.02	0.1728
48	B	13-Jan-02	10	11.283	0.0147	0.04	0.2762
49	B	16-Jan-02	11	11.225	0.0042	0.02	0.0791
49	B	26-Jan-02	11	11.192	0.0126	0.04	0.2369
49	B	13-Jan-02	11	11.25	0.0195	0.06	0.3673
50	B	26-Jan-02	11	11.2	0.0117	0.04	0.2211
50	B	13-Jan-02	11	11.25	0.0223	0.07	0.4201
50	B	23-Jan-02	11	11.25	0.0035	0.02	0.0658
51	B	16-Jan-02	11	11.242	0.0081	0.02	0.1519
51	B	26-Jan-02	11	11.217	0.0088	0.03	0.1649
51	B	13-Jan-02	11	11.275	0.0156	0.04	0.2929
52	B	16-Jan-02	12	11.242	0.0088	0.02	0.165
52	B	26-Jan-02	12	11.208	0.0084	0.03	0.1576
52	B	13-Jan-02	12	11.275	0.0152	0.04	0.2853
53	B	16-Jan-02	12	11.242	0.0084	0.02	0.1575
53	B	26-Jan-02	12	11.225	0.0085	0.03	0.1609
53	B	13-Jan-02	12	11.283	0.0144	0.04	0.2704
54	B	16-Jan-02	12	11.208	0.0133	0.04	0.2501
54	B	26-Jan-02	12	11.192	0.0091	0.04	0.1711
54	B	13-Jan-02	12	11.25	0.0196	0.06	0.3694
55	B	16-Jan-02	13	11.2	0.0143	0.05	0.2687
55	B	26-Jan-02	13	11.192	0.0087	0.03	0.1633
55	B	13-Jan-02	13	11.242	0.0196	0.06	0.3693
56	B	15-Jan-02	13	11.25	0.0094	0.03	0.1776
56	B	16-Jan-02	13	11.225	0.0009	0.01	0.0168
57	B	16-Jan-02	13	11.242	0.0092	0.03	0.1735
57	B	26-Jan-02	13	11.208	0.0066	0.03	0.1236
57	B	13-Jan-02	13	11.258	0.0148	0.04	0.2795
58	B	16-Jan-02	12	11.267	0.0042	0.01	0.0791
58	B	26-Jan-02	12	11.225	0.0062	0.02	0.1176
58	B	13-Jan-02	12	11.275	0.008	0.02	0.1501
59	B	16-Jan-02	12	11.225	0.0094	0.03	0.1766
59	B	26-Jan-02	12	11.2	0.0085	0.04	0.1593
59	B	13-Jan-02	12	11.242	0.0169	0.05	0.318
60	B	16-Jan-02	12	11.2	0.0148	0.05	0.2787

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
60	B	26-Jan-02	12	11.192	0.012	0.06	0.2267
60	B	13-Jan-02	12	11.217	0.0194	0.07	0.3644
61	B	16-Jan-02	13	11.208	0.0131	0.04	0.2461
61	B	26-Jan-02	13	11.192	0.0143	0.05	0.2699
61	B	13-Jan-02	13	11.217	0.0205	0.07	0.3869
62	B	16-Jan-02	13	11.208	0.0127	0.04	0.2389
62	B	26-Jan-02	13	11.192	0.0094	0.04	0.1776
62	B	13-Jan-02	13	11.233	0.0188	0.06	0.3546
63	B	16-Jan-02	13	11.208	0.0134	0.04	0.253
63	B	26-Jan-02	13	11.183	0.0156	0.06	0.2945
63	B	13-Jan-02	13	11.233	0.0204	0.07	0.3837
64	B	16-Jan-02	14	11.225	0.0099	0.03	0.1869
64	B	26-Jan-02	14	11.192	0.0115	0.04	0.2162
64	B	13-Jan-02	14	11.242	0.0148	0.05	0.279
65	B	16-Jan-02	14	11.242	0.0085	0.02	0.1595
65	B	26-Jan-02	14	11.2	0.0045	0.02	0.0849
65	B	13-Jan-02	14	11.267	0.0135	0.04	0.2535
66	B	16-Jan-02	14	11.208	0.013	0.04	0.2454
66	B	26-Jan-02	14	11.183	0.0134	0.05	0.2517
66	B	13-Jan-02	14	11.233	0.0219	0.07	0.413

\*—JMP 4.0 Outlier

N/D—Not Detected



### Appendix AA: Formate, Strata C

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	C	16-Jan-02	1	N/D	N/D	N/D	N/D
1	C	17-Jan-02	1	N/D	N/D	N/D	N/D
1	C	26-Jan-02	1	N/D	N/D	N/D	N/D
2	C	16-Jan-02	1	N/D	N/D	N/D	N/D
2	C	17-Jan-02	1	N/D	N/D	N/D	N/D
2	C	26-Jan-02	1	N/D	N/D	N/D	N/D
3	C	16-Jan-02	1	N/D	N/D	N/D	N/D
3	C	17-Jan-02	1	N/D	N/D	N/D	N/D
3	C	26-Jan-02	1	N/D	N/D	N/D	N/D
4	C	16-Jan-02	2	N/D	N/D	N/D	N/D
4	C	17-Jan-02	2	N/D	N/D	N/D	N/D
4	C	26-Jan-02	2	N/D	N/D	N/D	N/D
5	C	16-Jan-02	2	N/D	N/D	N/D	N/D
5	C	17-Jan-02	2	11.292	0.0024	0.01	0.0456
5	C	26-Jan-02	2	N/D	N/D	N/D	N/D
7	C	16-Jan-02	1	N/D	N/D	N/D	N/D
7	C	26-Jan-02	1	11.242	0.0002	0	0.004
7	C	22-Jan-02	1	N/D	N/D	N/D	N/D
8	C	26-Jan-02	1	N/D	N/D	N/D	N/D
8	C	23-Jan-02	1	N/D	N/D	N/D	N/D
8	C	22-Jan-02	1	N/D	N/D	N/D	N/D
9	C	16-Jan-02	1	11.283	0.0007	0	0.0136
9	C	26-Jan-02	1	N/D	N/D	N/D	N/D
9	C	22-Jan-02	1	N/D	N/D	N/D	N/D
10	C	16-Jan-02	2	N/D	N/D	N/D	N/D
10	C	26-Jan-02	2	N/D	N/D	N/D	N/D
10	C	6-Jan-02	2	N/D	N/D	N/D	N/D
11	C	16-Jan-02	2	N/D	N/D	N/D	N/D
11	C	26-Jan-02	2	N/D	N/D	N/D	N/D
11	C	6-Jan-02	2	N/D	N/D	N/D	N/D
12	C	16-Jan-02	2	N/D	N/D	N/D	N/D
12	C	26-Jan-02	2	N/D	N/D	N/D	N/D
12	C	23-Jan-02	2	N/D	N/D	N/D	N/D
13	C	16-Jan-02	3	N/D	N/D	N/D	N/D
13	C	10-Jan-02	3	N/D	N/D	N/D	N/D
13	C	26-Jan-02	3	N/D	N/D	N/D	N/D
14	C	10-Jan-02	3	N/D	N/D	N/D	N/D
14	C	26-Jan-02	3	N/D	N/D	N/D	N/D
14	C	23-Jan-02	3	N/D	N/D	N/D	N/D
15	C	10-Jan-02	3	N/D	N/D	N/D	N/D
15	C	26-Jan-02	3	N/D	N/D	N/D	N/D
15	C	23-Jan-02	3	N/D	N/D	N/D	N/D
16	C	10-Jan-02	4	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
16	C	26-Jan-02	4	N/D	N/D	N/D	N/D
16	C	6-Jan-02	4	N/D	N/D	N/D	N/D
17	C	10-Jan-02	4	N/D	N/D	N/D	N/D
17	C	26-Jan-02	4	N/D	N/D	N/D	N/D
17	C	23-Jan-02	4	N/D	N/D	N/D	N/D
18	C	10-Jan-02	4	N/D	N/D	N/D	N/D
18	C	26-Jan-02	4	N/D	N/D	N/D	N/D
18	C	23-Jan-02	4	N/D	N/D	N/D	N/D
19	C	16-Jan-02	3	N/D	N/D	N/D	N/D
19	C	10-Jan-02	3	N/D	N/D	N/D	N/D
20	C	16-Jan-02	3	N/D	N/D	N/D	N/D
20	C	10-Jan-02	3	N/D	N/D	N/D	N/D
20	C	26-Jan-02	3	11.367	0.0001	0	0.0016
21	C	10-Jan-02	3	N/D	N/D	N/D	N/D
21	C	26-Jan-02	3	11.233	0.0002	0	0.0041
21	C	6-Jan-02	3	N/D	N/D	N/D	N/D
22	C	5-Jan-02	4	N/D	N/D	N/D	N/D
22	C	10-Jan-02	4	N/D	N/D	N/D	N/D
22	C	6-Jan-02	4	N/D	N/D	N/D	N/D
23	C	5-Jan-02	4	N/D	N/D	N/D	N/D
23	C	10-Jan-02	4	N/D	N/D	N/D	N/D
23	C	6-Jan-02	4	N/D	N/D	N/D	N/D
24	C	5-Jan-02	4	N/D	N/D	N/D	N/D
24	C	10-Jan-02	4	11.083	0	0	0.0008
24	C	6-Jan-02	4	11.375	0.0006	0	0.0116
25	C	5-Jan-02	5	N/D	N/D	N/D	N/D
25	C	10-Jan-02	5	N/D	N/D	N/D	N/D
25	C	28-Jan-02	5	N/D	N/D	N/D	N/D
26	C	10-Jan-02	5	N/D	N/D	N/D	N/D
26	C	28-Jan-02	5	N/D	N/D	N/D	N/D
26	C	23-Jan-02	5	N/D	N/D	N/D	N/D
27	C	10-Jan-02	5	N/D	N/D	N/D	N/D
27	C	28-Jan-02	5	N/D	N/D	N/D	N/D
27	C	23-Jan-02	5	11.242	0.0007	0	0.013
28	C	5-Jan-02	6	N/D	N/D	N/D	N/D
28	C	10-Jan-02	6	N/D	N/D	N/D	N/D
28	C	6-Jan-02	6	11.342	0.0005	0	0.0088
29	C	5-Jan-02	6	11.3	0.0013	0.01	0.0252
29	C	10-Jan-02	6	11.35	0.0009	0.01	0.0166
29*	C	6-Jan-02	6	11.317	0.0185	0.06	0.3487
30	C	5-Jan-02	6	N/D	N/D	N/D	N/D
30	C	10-Jan-02	6	N/D	N/D	N/D	N/D
30	C	6-Jan-02	6	11.392	0.0007	0	0.014
31	C	5-Jan-02	5	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
31	C	10-Jan-02	5	N/D	N/D	N/D	N/D
31	C	28-Jan-02	5	N/D	N/D	N/D	N/D
32	C	10-Jan-02	5	N/D	N/D	N/D	N/D
32	C	28-Jan-02	5	N/D	N/D	N/D	N/D
32	C	23-Jan-02	5	N/D	N/D	N/D	N/D
33*	C	10-Jan-02	5	11.3	0.0149	0.04	0.2808
33	C	28-Jan-02	5	11.267	0.001	0	0.0194
33	C	23-Jan-02	5	N/D	N/D	N/D	N/D
34	C	5-Jan-02	8	N/D	N/D	N/D	N/D
34	C	10-Jan-02	8	N/D	N/D	N/D	N/D
34	C	6-Jan-02	8	11.367	0.0005	0	0.0095
35	C	5-Jan-02	8	11.342	0.0004	0	0.007
35	C	10-Jan-02	8	N/D	N/D	N/D	N/D
35	C	6-Jan-02	8	11.367	0.0003	0	0.0048
36	C	5-Jan-02	8	N/D	N/D	N/D	N/D
36	C	10-Jan-02	8	11.217	0	0	0.0007
36	C	6-Jan-02	8	11.325	0.0007	0.01	0.0137
37	C	5-Jan-02	7	11.333	0.0004	0	0.0072
37	C	10-Jan-02	7	N/D	N/D	N/D	N/D
37	C	28-Jan-02	7	11.158	0.0057	0.02	0.1078
37	C	6-Jan-02	7	11.35	0.0002	0	0.0044
38	C	10-Jan-02	7	N/D	N/D	N/D	N/D
38	C	28-Jan-02	7	N/D	N/D	N/D	N/D
38	C	6-Jan-02	7	11.333	0.0005	0	0.0091
39	C	10-Jan-02	7	N/D	N/D	N/D	N/D
39	C	28-Jan-02	7	N/D	N/D	N/D	N/D
39	C	23-Jan-02	7	N/D	N/D	N/D	N/D
40	C	10-Jan-02	8	N/D	N/D	N/D	N/D
40	C	28-Jan-02	8	11.592	0	0	0.0008
40	C	23-Jan-02	8	N/D	N/D	N/D	N/D
41	C	10-Jan-02	8	N/D	N/D	N/D	N/D
41	C	28-Jan-02	8	N/D	N/D	N/D	N/D
41	C	6-Jan-02	8	N/D	N/D	N/D	N/D
42	C	10-Jan-02	8	N/D	N/D	N/D	N/D
42	C	28-Jan-02	8	11	0.0002	0	0.0046
42	C	23-Jan-02	8	N/D	N/D	N/D	N/D
43	C	10-Jan-02	9	N/D	N/D	N/D	N/D
43	C	28-Jan-02	9	11.3	0.001	0	0.0195
43	C	6-Jan-02	9	11.317	0.0094	0.02	0.1776
44	C	10-Jan-02	9	N/D	N/D	N/D	N/D
44	C	28-Jan-02	9	N/D	N/D	N/D	N/D
44	C	23-Jan-02	9	N/D	N/D	N/D	N/D
45	C	10-Jan-02	9	N/D	N/D	N/D	N/D
45	C	28-Jan-02	9	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
45	C	23-Jan-02	9	11.3	0.0014	0	0.0262
46	C	28-Jan-02	10	N/D	N/D	N/D	N/D
46	C	10-Jan-02	10	11.383	0.0005	0	0.0094
46	C	23-Jan-02	10	N/D	N/D	N/D	N/D
47	C	28-Jan-02	10	N/D	N/D	N/D	N/D
47	C	10-Jan-02	10	N/D	N/D	N/D	N/D
47	C	23-Jan-02	10	N/D	N/D	N/D	N/D
48	C	28-Jan-02	10	N/D	N/D	N/D	N/D
48	C	10-Jan-02	10	N/D	N/D	N/D	N/D
48	C	6-Jan-02	10	11.342	0.0004	0	0.0068
49	C	28-Jan-02	11	11.233	0.0014	0.01	0.0257
49	C	10-Jan-02	11	N/D	N/D	N/D	N/D
49	C	6-Jan-02	11	N/D	N/D	N/D	N/D
50	C	28-Jan-02	11	11.308	0	0	0.0003
50	C	10-Jan-02	11	11.35	0.0005	0	0.0093
50	C	6-Jan-02	11	11.008	0	0	0.0007
51	C	28-Jan-02	11	N/D	N/D	N/D	N/D
51	C	10-Jan-02	11	N/D	N/D	N/D	N/D
51	C	6-Jan-02	11	11.325	0.001	0.01	0.0193
52	C	28-Jan-02	12	N/D	N/D	N/D	N/D
52	C	10-Jan-02	12	N/D	N/D	N/D	N/D
52	C	23-Jan-02	12	N/D	N/D	N/D	N/D
53	C	28-Jan-02	12	11.217	0.0039	0.01	0.0739
53	C	10-Jan-02	12	11.342	0.0005	0	0.0089
53	C	23-Jan-02	12	N/D	N/D	N/D	N/D
54	C	28-Jan-02	12	11.392	0	0	0.0004
54	C	10-Jan-02	12	11.317	0.0016	0.01	0.03
54	C	23-Jan-02	12	N/D	N/D	N/D	N/D
55	C	28-Jan-02	13	N/D	N/D	N/D	N/D
55	C	10-Jan-02	13	N/D	N/D	N/D	N/D
55	C	23-Jan-02	13	N/D	N/D	N/D	N/D
56	C	28-Jan-02	13	N/D	N/D	N/D	N/D
56	C	10-Jan-02	13	N/D	N/D	N/D	N/D
56	C	23-Jan-02	13	N/D	N/D	N/D	N/D
57	C	28-Jan-02	13	11.358	0	0	0.0003
57	C	10-Jan-02	13	N/D	N/D	N/D	N/D
57	C	23-Jan-02	13	N/D	N/D	N/D	N/D
58	C	28-Jan-02	12	N/D	N/D	N/D	N/D
58	C	10-Jan-02	12	N/D	N/D	N/D	N/D
58	C	23-Jan-02	12	11.258	0.0011	0	0.0206
59	C	28-Jan-02	12	N/D	N/D	N/D	N/D
59	C	10-Jan-02	12	N/D	N/D	N/D	N/D
59	C	23-Jan-02	12	11.242	0.0003	0	0.0054
60	C	28-Jan-02	12	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
60	C	10-Jan-02	12	N/D	N/D	N/D	N/D
60	C	6-Jan-02	12	11.375	0	0	0.0007
61	C	28-Jan-02	13	N/D	N/D	N/D	N/D
61	C	10-Jan-02	13	N/D	N/D	N/D	N/D
61	C	23-Jan-02	13	N/D	N/D	N/D	N/D
62	C	28-Jan-02	13	11.25	0.0012	0	0.0222
62	C	10-Jan-02	13	N/D	N/D	N/D	N/D
62	C	23-Jan-02	13	N/D	N/D	N/D	N/D
63	C	28-Jan-02	13	11.25	0.0007	0	0.0133
63	C	10-Jan-02	13	N/D	N/D	N/D	N/D
63	C	23-Jan-02	13	11.325	0.001	0	0.0181
64	C	28-Jan-02	14	N/D	N/D	N/D	N/D
64	C	10-Jan-02	14	N/D	N/D	N/D	N/D
64	C	23-Jan-02	14	N/D	N/D	N/D	N/D
65	C	28-Jan-02	14	11.242	0.0012	0.01	0.0231
65	C	10-Jan-02	14	11.208	0.0001	0	0.0025
65	C	23-Jan-02	14	11.25	0.0011	0	0.0202
66	C	28-Jan-02	14	N/D	N/D	N/D	N/D
66	C	10-Jan-02	14	N/D	N/D	N/D	N/D
66	C	23-Jan-02	14	N/D	N/D	N/D	N/D

\*—JMP 4.0 Outlier

N/D—Not Detected

**Appendix AB: Formate, Field Blanks, Influent and Effluent**

<b>Piezometer</b>	<b>Strata</b>	<b>Date Taken</b>	<b>Plot</b>	<b>Retention Time (min)</b>	<b>Area (<math>\mu\text{S} \cdot \text{min}</math>)</b>	<b>Height (<math>\mu\text{S}</math>)</b>	<b>Amount (ppm)</b>
Blank	BLANK	10-Jan-02	B	N/D	N/D	N/D	N/D
Blank	BLANK	26-Jan-02	B	N/D	N/D	N/D	N/D
Blank	BLANK	28-Jan-02	B	N/D	N/D	N/D	N/D
Influent	INFLUENT	5-Jan-02	I	N/D	N/D	N/D	N/D
Influent	INFLUENT	10-Jan-02	I	N/D	N/D	N/D	N/D
Influent	INFLUENT	6-Jan-02	I	11.333	0.0004	0	0.0076
Effluent	EFFLUENT	5-Jan-02	E	11.35	0.0004	0	0.0079
Effluent	EFFLUENT	10-Jan-02	E	11.317	0.0006	0	0.013
Effluent	EFFLUENT	6-Jan-02	E	11.333	0.0009	0	0.0179

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix AC: Lactate, Strata A

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	A	16-Jan-02	1	8.025	0.002	0.01	0.0246
1	A	17-Jan-02	1	7.925	0.0004	0	0.0053
1	A	23-Jan-02	1	8.058	0.0049	0.02	0.0599
2	A	16-Jan-02	1	7.95	0.0089	0.03	0.109
2	A	17-Jan-02	1	7.892	0.0012	0	0.0142
2	A	23-Jan-02	1	7.958	0.0061	0.03	0.0749
3	A	18-Jan-02	1	7.925	0.0026	0.01	0.0316
3	A	16-Jan-02	1	7.9	0.0032	0.01	0.0399
3	A	17-Jan-02	1	7.9	0.0014	0	0.0172
4	A	18-Jan-02	2	7.9	0.003	0.01	0.0365
4	A	16-Jan-02	2	7.908	0.0021	0.01	0.0252
4	A	17-Jan-02	2	7.858	0.0012	0	0.0146
5	A	18-Jan-02	2	7.858	0.0034	0.02	0.042
5	A	16-Jan-02	2	7.867	0.002	0.01	0.0252
5	A	17-Jan-02	2	N/D	N/D	N/D	N/D
6	A	18-Jan-02	2	7.875	0.0014	0.01	0.0175
6	A	16-Jan-02	2	7.883	0.0023	0.01	0.0284
6	A	17-Jan-02	2	7.825	0.0012	0.01	0.0151
7	A	17-Jan-02	1	7.917	0.0028	0.01	0.0347
7	A	23-Jan-02	1	7.933	0.0062	0.02	0.0764
8	A	18-Jan-02	1	7.908	0.001	0	0.0117
8	A	16-Jan-02	1	7.892	0.0009	0	0.0115
8	A	17-Jan-02	1	7.908	0.0015	0.01	0.0189
9	A	18-Jan-02	1	7.9	0.0018	0.01	0.0226
9	A	16-Jan-02	1	7.917	0.003	0.01	0.0372
9	A	17-Jan-02	1	7.892	0.0013	0	0.0161
10	A	18-Jan-02	2	7.942	0.0056	0.02	0.0693
10	A	10-Jan-02	2	8.117	0.0215	0.09	0.2647
10	A	16-Jan-02	2	7.958	0.0019	0.01	0.0229
10	A	14-Jan-02	2	8.1	0.0062	0.03	0.0759
11	A	18-Jan-02	2	7.85	0.0022	0.01	0.0268
11	A	10-Jan-02	2	N/D	N/D	N/D	N/D
11	A	16-Jan-02	2	7.875	0.0007	0	0.0092
11	A	14-Jan-02	2	7.975	0.0015	0.01	0.0179
12	A	18-Jan-02	2	7.858	0.0027	0.01	0.0337
12	A	10-Jan-02	2	7.9	0.002	0.01	0.0251
12	A	16-Jan-02	2	7.867	0.0021	0.01	0.0253
13	A	18-Jan-02	3	7.9	0.0019	0.01	0.0232
13	A	16-Jan-02	3	7.858	0.0015	0.01	0.0182
13	A	17-Jan-02	3	7.858	0.0019	0.01	0.023
14	A	18-Jan-02	3	7.85	0.0016	0.01	0.0198
14	A	23-Jan-02	3	7.825	0.0017	0.01	0.0212
14	A	14-Jan-02	3	7.975	0.0036	0.01	0.0447

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
15	A	18-Jan-02	3	7.842	0.0016	0.01	0.0202
15	A	17-Jan-02	3	7.883	0.0018	0.01	0.0226
15	A	23-Jan-02	3	7.867	0.007	0.03	0.0866
16	A	18-Jan-02	4	7.917	0.0056	0.02	0.0693
16	A	10-Jan-02	4	8.025	0.0066	0.03	0.0818
16	A	23-Jan-02	4	7.925	0.0117	0.05	0.1442
17	A	17-Jan-02	4	7.942	0.0029	0.01	0.0352
17	A	18-Jan-02	4	8.025	0.0028	0.01	0.0344
17	A	23-Jan-02	4	7.85	0.017	0.06	0.2098
18	A	18-Jan-02	4	7.942	0.0023	0.01	0.0284
18	A	23-Jan-02	4	7.833	0.0019	0.01	0.0235
18	A	14-Jan-02	4	8.008	0.0051	0.02	0.0625
19	A	17-Jan-02	3	7.85	0.001	0	0.0126
19	A	18-Jan-02	3	7.9	0.0063	0.02	0.0771
19	A	24-Jan-02	3	7.817	0.0019	0.01	0.0229
20	A	10-Jan-02	3	8.033	0.0152	0.06	0.1875
20	A	18-Jan-02	3	7.983	0.008	0.03	0.0982
20*	A	23-Jan-02	3	7.95	0.034	0.14	0.4192
21	A	10-Jan-02	3	8.017	0.004	0.02	0.0489
21	A	18-Jan-02	3	7.958	0.0018	0.01	0.0221
21	A	23-Jan-02	3	7.883	0.0038	0.02	0.047
22	A	10-Jan-02	4	8.033	0.0067	0.02	0.082
22	A	18-Jan-02	4	7.975	0.0077	0.03	0.0953
22	A	23-Jan-02	4	7.942	0.0024	0.01	0.0295
23	A	10-Jan-02	4	8.05	0.0039	0.02	0.048
23	A	18-Jan-02	4	7.967	0.0021	0.01	0.0257
23	A	14-Jan-02	4	8.1	0.0018	0.01	0.022
24	A	10-Jan-02	4	8.025	0.0015	0.01	0.0182
24	A	18-Jan-02	4	7.908	0.002	0.01	0.025
24	A	14-Jan-02	4	8.033	0.0041	0.01	0.0507
25	A	10-Jan-02	5	8.033	0.0053	0.02	0.065
25*	A	18-Jan-02	5	7.933	0.0221	0.09	0.2722
25	A	23-Jan-02	5	7.933	0.0026	0.01	0.0314
26	A	17-Jan-02	5	N/D	N/D	N/D	N/D
26	A	18-Jan-02	5	7.85	0.0026	0.01	0.0318
26	A	23-Jan-02	5	7.858	0.0011	0.01	0.0131
27	A	18-Jan-02	5	7.892	0.0031	0.01	0.038
27	A	23-Jan-02	5	7.883	0.0044	0.01	0.0536
27	A	14-Jan-02	5	7.958	0.0085	0.04	0.1048
28	A	10-Jan-02	6	8.025	0.0024	0.01	0.0297
28	A	18-Jan-02	6	7.85	0.0048	0.02	0.0593
28*	A	23-Jan-02	6	7.825	0.0243	0.08	0.2986
29	A	10-Jan-02	6	8.008	0.0019	0.01	0.023
29	A	18-Jan-02	6	7.967	0.0102	0.04	0.1262



Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
29	A	23-Jan-02	6	7.925	0.0018	0.01	0.0222
30	A	10-Jan-02	6	7.975	0.0019	0.01	0.0232
30	A	18-Jan-02	6	7.958	0.008	0.03	0.0988
30	A	24-Jan-02	6	7.908	0.0019	0.01	0.0232
31	A	10-Jan-02	5	7.983	0.0019	0.01	0.0231
31	A	18-Jan-02	5	7.908	0.0025	0.01	0.0312
31	A	14-Jan-02	5	8.05	0.0057	0.02	0.0697
32	A	17-Jan-02	5	7.983	0.0012	0	0.0151
32	A	18-Jan-02	5	7.858	0.0098	0.04	0.1201
32	A	23-Jan-02	5	7.817	0.0019	0.01	0.0233
33	A	18-Jan-02	5	7.908	0.0019	0.01	0.0231
33	A	23-Jan-02	5	7.908	0.0025	0.01	0.0312
33	A	14-Jan-02	5	7.967	0.0066	0.02	0.0809
34*	A	22-Jan-02	8	8.025	0.0243	0.09	0.2997
34	A	10-Jan-02	8	7.942	0.0019	0.01	0.0233
34	A	24-Jan-02	8	7.867	0.0017	0.01	0.0204
35	A	22-Jan-02	8	8.033	0.0177	0.07	0.2178
35	A	10-Jan-02	8	7.975	0.0018	0.01	0.0223
35	A	24-Jan-02	8	7.917	0.0026	0.01	0.0316
36	A	17-Jan-02	8	8.05	0.0016	0.01	0.0198
36	A	22-Jan-02	8	8.008	0.0146	0.06	0.1801
36	A	24-Jan-02	8	7.925	0.0024	0.01	0.0292
37	A	22-Jan-02	7	8	0.0073	0.03	0.0905
37	A	10-Jan-02	7	7.967	0.0025	0.01	0.0312
37	A	24-Jan-02	7	7.892	0.0005	0	0.0056
38	A	22-Jan-02	7	7.95	0.0026	0.01	0.0321
38	A	10-Jan-02	7	7.933	0.002	0.01	0.0242
38	A	24-Jan-02	7	7.892	0.0024	0.01	0.0302
39	A	17-Jan-02	7	7.933	0.0024	0.01	0.0294
39	A	22-Jan-02	7	7.917	0.0021	0.01	0.0264
39	A	24-Jan-02	7	7.95	0.0012	0.01	0.0149
40	A	17-Jan-02	8	7.875	0.001	0	0.0126
40	A	22-Jan-02	8	7.875	0.0119	0.04	0.1467
40	A	24-Jan-02	8	N/D	N/D	N/D	N/D
41	A	22-Jan-02	8	7.867	0.0071	0.02	0.0871
41	A	10-Jan-02	8	7.875	0	0	0.0004
41	A	24-Jan-02	8	N/D	N/D	N/D	N/D
42	A	17-Jan-02	8	7.942	0.0021	0.01	0.0259
42	A	22-Jan-02	8	7.858	0.0102	0.03	0.1254
42	A	24-Jan-02	8	7.833	0.0024	0.01	0.03
43	A	22-Jan-02	9	7.883	0.0043	0.02	0.0529
43	A	10-Jan-02	9	7.9	0.0009	0	0.0111
43	A	14-Jan-02	9	7.983	0.0023	0.01	0.0279
44	A	22-Jan-02	9	7.875	0.0074	0.02	0.0916

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
44	A	10-Jan-02	9	7.908	0.0011	0.01	0.0139
44	A	14-Jan-02	9	7.892	0.0037	0.01	0.0457
45	A	22-Jan-02	9	7.858	0.0072	0.03	0.0891
45	A	10-Jan-02	9	7.867	0.0012	0.01	0.0149
45	A	24-Jan-02	9	7.817	0.0023	0.01	0.0283
46	A	17-Jan-02	10	7.908	0.0016	0.01	0.0192
46	A	22-Jan-02	10	7.858	0.0025	0.01	0.0308
46	A	24-Jan-02	10	7.95	0.0012	0	0.0142
47	A	17-Jan-02	10	7.975	0.0009	0	0.0109
47	A	22-Jan-02	10	7.85	0.0047	0.02	0.0573
47	A	24-Jan-02	10	7.917	0.003	0.01	0.0366
48	A	22-Jan-02	10	7.867	0.0047	0.02	0.0583
48	A	10-Jan-02	10	7.867	0.0021	0.01	0.0257
48	A	14-Jan-02	10	7.925	0.0027	0.01	0.0334
49	A	22-Jan-02	11	7.85	0.0081	0.03	0.0994
49	A	10-Jan-02	11	7.833	0.002	0.01	0.0243
49	A	24-Jan-02	11	N/D	N/D	N/D	N/D
50	A	22-Jan-02	11	7.85	0.0019	0.01	0.0235
50	A	10-Jan-02	11	7.817	0.0009	0	0.0114
50	A	24-Jan-02	11	N/D	N/D	N/D	N/D
51	A	22-Jan-02	11	7.883	0.0023	0.01	0.0278
51	A	10-Jan-02	11	7.942	0.0026	0.01	0.0317
51	A	24-Jan-02	11	N/D	N/D	N/D	N/D
52	A	17-Jan-02	12	7.95	0.0016	0.01	0.0202
52	A	22-Jan-02	12	7.917	0.0089	0.03	0.1094
52	A	24-Jan-02	12	N/D	N/D	N/D	N/D
53	A	17-Jan-02	12	7.967	0.0025	0.01	0.031
53	A	22-Jan-02	12	7.942	0.0125	0.05	0.1544
53	A	24-Jan-02	12	N/D	N/D	N/D	N/D
54	A	22-Jan-02	12	7.842	0.0057	0.02	0.0701
54	A	10-Jan-02	12	7.933	0.0032	0.01	0.0392
54	A	24-Jan-02	12	N/D	N/D	N/D	N/D
55	A	22-Jan-02	13	7.85	0.0156	0.06	0.1915
55	A	10-Jan-02	13	7.842	0.0015	0.01	0.0184
55	A	24-Jan-02	13	N/D	N/D	N/D	N/D
56	A	17-Jan-02	13	7.867	0.01	0.04	0.1228
56	A	22-Jan-02	13	7.817	0.006	0.02	0.0742
56	A	24-Jan-02	13	N/D	N/D	N/D	N/D
57	A	22-Jan-02	13	7.858	0.0058	0.02	0.0711
57	A	10-Jan-02	13	7.875	0.0022	0.01	0.0266
57	A	24-Jan-02	13	N/D	N/D	N/D	N/D
58	A	22-Jan-02	12	7.883	0.0037	0.02	0.0454
58	A	10-Jan-02	12	7.867	0.0021	0.01	0.0255
58	A	24-Jan-02	12	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
59	A	22-Jan-02	12	7.858	0.0081	0.03	0.0993
59	A	10-Jan-02	12	7.875	0.0018	0.01	0.0227
59	A	24-Jan-02	12	N/D	N/D	N/D	N/D
60	A	22-Jan-02	12	7.867	0.0057	0.02	0.0706
60	A	10-Jan-02	12	7.85	0.0043	0.02	0.053
60	A	14-Jan-02	12	7.908	0.0093	0.03	0.1139
61	A	22-Jan-02	13	7.958	0.0028	0.01	0.0341
61	A	10-Jan-02	13	7.883	0.0046	0.02	0.0567
61	A	14-Jan-02	13	7.9	0.0189	0.07	0.2331
62	A	22-Jan-02	13	7.833	0.0023	0.01	0.0287
62	A	10-Jan-02	13	N/D	N/D	N/D	N/D
62	A	24-Jan-02	13	N/D	N/D	N/D	N/D
63	A	22-Jan-02	13	7.892	0.0087	0.03	0.1072
63	A	10-Jan-02	13	7.833	0.0067	0.02	0.083
63*	A	14-Jan-02	13	7.867	0.0715	0.26	0.8802
64	A	22-Jan-02	14	7.875	0.0098	0.04	0.1208
64	A	10-Jan-02	14	7.85	0.002	0.01	0.0252
64	A	24-Jan-02	14	N/D	N/D	N/D	N/D
65	A	17-Jan-02	14	8.05	0.0008	0	0.0102
65	A	22-Jan-02	14	7.933	0.0089	0.04	0.1098
65	A	24-Jan-02	14	N/D	N/D	N/D	N/D
66	A	17-Jan-02	14	7.9	0.0056	0.02	0.0692
66	A	23-Jan-02	14	7.842	0.0076	0.03	0.0934
66	A	24-Jan-02	14	N/D	N/D	N/D	N/D

\*—JMP 4.0 Outlier

N/D—Not Detected

**Appendix AD: Lactate, Strata B**

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
1	B	25-Jan-02	1	8.033	0.0022	0.01	0.1244
1	B	17-Jan-02	1	7.95	0	0	0.0007
1	B	15-Jan-02	1	8.025	0.0035	0.01	0.1989
2	B	25-Jan-02	1	7.908	0.0081	0.03	0.4652
2	B	13-Jan-02	1	8.042	0.0021	0.01	0.122
2	B	15-Jan-02	1	7.983	0.0019	0.01	0.1102
3	B	25-Jan-02	1	7.95	0.0031	0.01	0.176
3	B	13-Jan-02	1	8.05	0.0042	0.01	0.2394
3	B	15-Jan-02	1	8.1	0.0033	0.01	0.1889
4	B	25-Jan-02	2	7.95	0.0088	0.03	0.5033
4*	B	13-Jan-02	2	8.017	0.0204	0.08	1.1661
4	B	15-Jan-02	2	8.125	0.0024	0.01	0.1388
5	B	25-Jan-02	2	7.875	0.0019	0.01	0.1079
5	B	17-Jan-02	2	7.867	0.0021	0.01	0.1228
5	B	15-Jan-02	2	7.983	0.0013	0.01	0.0765
6	B	25-Jan-02	2	7.867	0.0058	0.02	0.3287
6	B	13-Jan-02	2	7.967	0.011	0.04	0.6298
6	B	15-Jan-02	2	7.992	0.0039	0.01	0.2212
7	B	25-Jan-02	1	7.908	0.0034	0.01	0.1918
7	B	17-Jan-02	1	8.025	0.001	0	0.055
7	B	15-Jan-02	1	8.008	0.0057	0.02	0.3284
8	B	25-Jan-02	1	7.883	0.0047	0.03	0.2671
8	B	13-Jan-02	1	8.025	0.0039	0.01	0.2245
8	B	15-Jan-02	1	8.05	0.0025	0.01	0.1424
9	B	25-Jan-02	1	7.933	0.0027	0.01	0.1526
9	B	13-Jan-02	1	8.042	0.0039	0.02	0.2247
9	B	15-Jan-02	1	8.008	0.0036	0.01	0.2085
10	B	25-Jan-02	2	7.925	0.0029	0.01	0.1663
10	B	13-Jan-02	2	8.017	0.0078	0.03	0.4474
10	B	15-Jan-02	2	7.983	0.0006	0	0.036
11	B	25-Jan-02	2	7.867	0.0015	0.01	0.0867
11*	B	13-Jan-02	2	8.133	0.0173	0.79	0.9913
11	B	15-Jan-02	2	8.033	0.0009	0	0.0508
12	B	25-Jan-02	2	7.892	0.0017	0.01	0.0952
12*	B	13-Jan-02	2	7.925	0.0135	0.04	0.7693
12	B	15-Jan-02	2	8.025	0.0011	0.01	0.0638
13	B	17-Jan-02	3	7.95	0.0015	0.01	0.0863
14	B	25-Jan-02	3	7.925	0.0022	0.01	0.1271
14	B	13-Jan-02	3	8.033	0.0059	0.06	0.3351
14	B	15-Jan-02	3	8.033	0.002	0.01	0.1161
15	B	25-Jan-02	3	7.917	0.0036	0.01	0.2037
15	B	13-Jan-02	3	7.975	0.0084	0.02	0.4811
15	B	15-Jan-02	3	7.992	0.0019	0.01	0.1099

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
16	B	25-Jan-02	4	7.883	0.0073	0.02	0.4162
16	B	13-Jan-02	4	8	0.0089	0.03	0.5069
16	B	15-Jan-02	4	8.067	0.0045	0.01	0.2567
17	B	25-Jan-02	4	7.85	0.0022	0.01	0.1285
17	B	17-Jan-02	4	7.925	0.0008	0	0.0468
17	B	15-Jan-02	4	8.008	0.0012	0.01	0.0681
18	B	25-Jan-02	4	7.875	0.0012	0	0.0658
18	B	17-Jan-02	4	7.9	0.001	0	0.0554
18	B	15-Jan-02	4	7.925	0.0031	0.01	0.1763
19	B	25-Jan-02	3	7.858	0.0063	0.02	0.359
19	B	17-Jan-02	3	7.925	0.0013	0.01	0.0725
19	B	16-Jan-02	3	7.958	0.0037	0.01	0.2118
20	B	25-Jan-02	3	7.883	0.0038	0.02	0.2183
20	B	13-Jan-02	3	7.992	0.0059	0.02	0.3371
20	B	15-Jan-02	3	8.008	0.0014	0	0.0802
21	B	25-Jan-02	3	7.892	0.0034	0.01	0.1919
21	B	13-Jan-02	3	8.017	0.0044	0.02	0.2538
21	B	15-Jan-02	3	8.108	0.0028	0.01	0.1578
22	B	25-Jan-02	4	7.9	0.002	0.01	0.1133
22	B	13-Jan-02	4	8.008	0.0029	0.01	0.1663
22	B	15-Jan-02	4	7.983	0.0014	0.01	0.0796
23	B	25-Jan-02	4	7.9	0.0022	0.01	0.1236
23	B	13-Jan-02	4	8.058	0.0081	0.02	0.4631
23	B	15-Jan-02	4	8.058	0.0081	0.02	0.4652
24	B	25-Jan-02	4	7.975	0.0027	0.01	0.153
24	B	13-Jan-02	4	8.008	0.0041	0.01	0.2336
24	B	15-Jan-02	4	7.975	0.0042	0.01	0.2399
25	B	25-Jan-02	5	7.883	0.0019	0.01	0.1111
25*	B	13-Jan-02	5	7.95	0.0122	0.04	0.6974
25	B	15-Jan-02	5	8.033	0.0019	0.01	0.1086
26	B	25-Jan-02	5	7.858	0.0017	0.01	0.097
26	B	13-Jan-02	5	7.908	0.0032	0.01	0.181
26	B	15-Jan-02	5	7.983	0.0009	0	0.0503
27	B	25-Jan-02	5	7.875	0.0031	0.01	0.1753
27	B	13-Jan-02	5	7.917	0.0018	0.01	0.1027
27	B	15-Jan-02	5	7.892	0.0019	0.01	0.1095
28	B	25-Jan-02	6	7.908	0.0027	0.01	0.156
28*	B	13-Jan-02	6	7.908	0.0126	0.04	0.7205
28	B	15-Jan-02	6	7.933	0.0082	0.02	0.4693
29	B	25-Jan-02	6	7.9	0.0024	0.01	0.1348
29	B	13-Jan-02	6	7.975	0.0021	0.01	0.1224
29	B	15-Jan-02	6	7.958	0.0014	0	0.0794
30	B	25-Jan-02	6	7.883	0.0035	0.01	0.1976
30	B	13-Jan-02	6	7.925	0.0086	0.03	0.4929

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
30	B	15-Jan-02	6	8.05	0.0024	0.01	0.136
31	B	25-Jan-02	5	7.867	0.0071	0.02	0.4068
31	B	13-Jan-02	5	7.95	0.0042	0.02	0.2425
31	B	15-Jan-02	5	7.983	0.0052	0.02	0.2971
32	B	13-Jan-02	5	7.933	0.0019	0.01	0.1066
32	B	15-Jan-02	5	7.925	0.0015	0.01	0.0869
32	B	16-Jan-02	5	8.008	0.0094	0.03	0.539
33	B	25-Jan-02	5	7.892	0.0033	0.01	0.1861
33	B	13-Jan-02	5	7.983	0.0024	0.01	0.1379
33	B	15-Jan-02	5	7.958	0.0026	0.01	0.1463
34	B	16-Jan-02	8	8.025	0.0046	0.02	0.2637
34	B	26-Jan-02	8	8	0.0023	0.01	0.1314
34	B	13-Jan-02	8	8.15	0.0034	0.01	0.1927
35	B	16-Jan-02	8	8.008	0.0115	0.04	0.6588
35	B	26-Jan-02	8	8	0.002	0.01	0.1156
35	B	13-Jan-02	8	8.167	0.0025	0.01	0.1424
36	B	16-Jan-02	8	7.975	0.0059	0.02	0.3351
36	B	26-Jan-02	8	7.95	0.0022	0.01	0.1235
36	B	13-Jan-02	8	8.1	0.0024	0.01	0.1352
37	B	26-Jan-02	7	7.917	0.0028	0.01	0.1577
37	B	13-Jan-02	7	7.992	0.0047	0.02	0.2691
37	B	23-Jan-02	7	7.958	0.0028	0.01	0.1618
38	B	16-Jan-02	7	7.925	0.0074	0.02	0.423
38	B	26-Jan-02	7	7.883	0.0024	0.01	0.1352
38	B	13-Jan-02	7	8.05	0.0016	0.01	0.0942
39*	B	16-Jan-02	7	7.908	0.015	0.04	0.8588
39	B	26-Jan-02	7	7.925	0.0039	0.01	0.2217
39	B	13-Jan-02	7	8.033	0.0022	0.01	0.1252
40	B	16-Jan-02	8	7.867	0.0105	0.04	0.6011
40	B	26-Jan-02	8	7.867	0.0013	0.01	0.073
40	B	13-Jan-02	8	7.942	0.0034	0.01	0.1942
41	B	16-Jan-02	8	7.925	0.0029	0.01	0.1676
41	B	26-Jan-02	8	7.875	0.0027	0.01	0.1537
41	B	13-Jan-02	8	7.983	0.0018	0.01	0.1019
42	B	16-Jan-02	8	7.925	0.0037	0.01	0.2104
42	B	26-Jan-02	8	7.875	0.0016	0.01	0.0915
42	B	13-Jan-02	8	7.933	0.0044	0.02	0.2536
43	B	16-Jan-02	9	7.967	0.0062	0.02	0.3568
43	B	26-Jan-02	9	7.867	0.0018	0.01	0.1041
43	B	13-Jan-02	9	7.992	0.0051	0.01	0.2925
44	B	16-Jan-02	9	7.917	0.0028	0.01	0.1577
44	B	26-Jan-02	9	7.85	0.0024	0.01	0.1382
44	B	13-Jan-02	9	7.933	0.0043	0.02	0.245
45	B	16-Jan-02	9	7.908	0.0107	0.04	0.6122

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
45	B	26-Jan-02	9	7.858	0.0015	0.01	0.0844
45	B	13-Jan-02	9	7.975	0.0019	0.01	0.1082
46	B	16-Jan-02	10	7.9	0.0105	0.03	0.5973
46	B	26-Jan-02	10	7.842	0.0019	0.01	0.1113
46	B	13-Jan-02	10	7.975	0.0014	0.01	0.0825
47	B	16-Jan-02	10	7.892	0.0106	0.03	0.6057
47	B	26-Jan-02	10	7.842	0.0016	0.01	0.091
47	B	13-Jan-02	10	7.908	0.0021	0.01	0.1225
48	B	15-Jan-02	10	7.917	0.0029	0.01	0.1633
48	B	16-Jan-02	10	7.975	0.0004	0	0.0225
48	B	13-Jan-02	10	8.017	0.0023	0.01	0.1319
49	B	16-Jan-02	11	7.85	0.0021	0.01	0.1197
49	B	26-Jan-02	11	7.833	0.0008	0	0.0476
49	B	13-Jan-02	11	7.892	0.0032	0.01	0.1857
50	B	26-Jan-02	11	7.858	0.0104	0.03	0.5924
50	B	13-Jan-02	11	7.958	0.0016	0.01	0.0935
50	B	23-Jan-02	11	7.9	0.0096	0.03	0.546
51	B	16-Jan-02	11	7.9	0.0118	0.04	0.6736
51	B	26-Jan-02	11	7.892	0.0018	0.01	0.1049
51	B	13-Jan-02	11	7.967	0.0027	0.01	0.1551
52	B	16-Jan-02	12	7.942	0.0065	0.02	0.3693
52	B	26-Jan-02	12	7.892	0.0024	0.01	0.1354
52	B	13-Jan-02	12	7.992	0.0026	0.01	0.1492
53	B	16-Jan-02	12	7.933	0.0042	0.02	0.2423
53	B	26-Jan-02	12	7.892	0.003	0.01	0.1719
53	B	13-Jan-02	12	8	0.0037	0.01	0.2101
54	B	16-Jan-02	12	7.917	0.004	0.01	0.2291
54	B	26-Jan-02	12	7.925	0.0032	0.01	0.1826
54	B	13-Jan-02	12	8.008	0.0024	0.01	0.1385
55	B	16-Jan-02	13	7.875	0.0021	0.01	0.1225
55	B	26-Jan-02	13	7.858	0.001	0	0.0599
55	B	13-Jan-02	13	7.942	0.0013	0.01	0.0758
56	B	15-Jan-02	13	7.925	0.0067	0.02	0.3828
56	B	16-Jan-02	13	7.983	0.0017	0.01	0.095
57	B	16-Jan-02	13	7.983	0.0075	0.02	0.4304
57	B	26-Jan-02	13	7.917	0.0021	0.01	0.1194
57	B	13-Jan-02	13	7.967	0.0042	0.02	0.2396
58	B	16-Jan-02	12	7.958	0.0047	0.02	0.2698
58	B	26-Jan-02	12	7.925	0.0031	0.01	0.1746
58	B	13-Jan-02	12	7.983	0.0017	0.01	0.0999
59	B	16-Jan-02	12	7.892	0.006	0.02	0.3408
59	B	26-Jan-02	12	7.867	0.0021	0.01	0.1221
59	B	13-Jan-02	12	7.925	0.0035	0.01	0.2014
60	B	16-Jan-02	12	7.875	0.0042	0.02	0.2398

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
60	B	26-Jan-02	12	7.867	0.0037	0.01	0.2119
60	B	13-Jan-02	12	7.892	0.0027	0.01	0.1526
61	B	16-Jan-02	13	7.908	0.0021	0.01	0.1214
61	B	26-Jan-02	13	7.883	0.0055	0.02	0.3143
61	B	13-Jan-02	13	7.875	0.0027	0.01	0.1552
62	B	16-Jan-02	13	7.875	0.0082	0.02	0.4705
62	B	26-Jan-02	13	7.908	0.0017	0.01	0.0991
62	B	13-Jan-02	13	7.925	0.0026	0.01	0.1481
63	B	16-Jan-02	13	7.975	0.0039	0.02	0.2236
63	B	26-Jan-02	13	7.842	0.0021	0.01	0.1181
63	B	13-Jan-02	13	7.9	0.0068	0.02	0.3902
64	B	16-Jan-02	14	7.95	0.0027	0.01	0.1571
64	B	26-Jan-02	14	7.908	0.0013	0.01	0.0715
64	B	13-Jan-02	14	8.008	0.0024	0.01	0.139
65	B	16-Jan-02	14	8.025	0.0032	0.01	0.1845
65	B	26-Jan-02	14	7.975	0.0012	0	0.0712
65	B	13-Jan-02	14	8	0.0014	0.01	0.0797
66	B	16-Jan-02	14	7.917	0.0046	0.02	0.2638
66	B	26-Jan-02	14	7.933	0.0038	0.01	0.216
66	B	13-Jan-02	14	7.975	0.0057	0.02	0.3246

\*—JMP 4.0 Outlier

N/D—Not Detected



### Appendix AE: Lactate, Strata C

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	C	16-Jan-02	1	8.067	0.0004	0	0.0232
1	C	17-Jan-02	1	7.992	0.0002	0	0.0131
1	C	26-Jan-02	1	8.008	0.0006	0	0.0325
2	C	16-Jan-02	1	8.042	0.0005	0	0.0258
2	C	17-Jan-02	1	8.233	0	0	0.0017
2	C	26-Jan-02	1	7.992	0.0013	0.01	0.0743
3	C	16-Jan-02	1	8.008	0.0003	0	0.0194
3	C	17-Jan-02	1	N/D	N/D	N/D	N/D
3	C	26-Jan-02	1	7.983	0.0016	0.01	0.0925
4	C	16-Jan-02	2	8.025	0.0005	0	0.0263
4	C	17-Jan-02	2	7.958	0.0007	0	0.0398
4	C	26-Jan-02	2	7.975	0.0028	0.01	0.1625
5	C	16-Jan-02	2	7.992	0.0007	0	0.0384
5	C	17-Jan-02	2	7.958	0.0005	0	0.0283
5	C	26-Jan-02	2	7.975	0.0017	0.01	0.0991
7	C	16-Jan-02	1	7.958	0.0008	0	0.0436
7	C	26-Jan-02	1	7.933	0.0072	0.03	0.4087
7	C	22-Jan-02	1	N/D	N/D	N/D	N/D
8	C	26-Jan-02	1	7.95	0.0017	0.01	0.0968
8	C	23-Jan-02	1	7.975	0.0006	0	0.036
8	C	22-Jan-02	1	N/D	N/D	N/D	N/D
9	C	16-Jan-02	1	7.992	0.0258	0.11	1.474
9	C	26-Jan-02	1	7.933	0.0007	0	0.0426
9	C	22-Jan-02	1	N/D	N/D	N/D	N/D
10	C	16-Jan-02	2	7.983	0.0006	0	0.032
10	C	26-Jan-02	2	7.95	0.0019	0.01	0.1108
10	C	6-Jan-02	2	7.933	0	0	0.0014
11	C	16-Jan-02	2	7.983	0.0018	0.01	0.1016
11	C	26-Jan-02	2	7.975	0.0007	0	0.0386
11	C	6-Jan-02	2	8.167	0	0	0.0012
12	C	16-Jan-02	2	7.992	0.0026	0.01	0.1478
12	C	26-Jan-02	2	7.958	0.0008	0	0.0454
12	C	23-Jan-02	2	7.958	0.0011	0	0.0605
13	C	16-Jan-02	3	7.983	0.0022	0.01	0.125
13	C	10-Jan-02	3	8.15	0	0	0.0007
13	C	26-Jan-02	3	7.933	0.0013	0.01	0.0752
14	C	10-Jan-02	3	8.058	0	0	0.0011
14	C	26-Jan-02	3	7.933	0.0009	0	0.0535
14	C	23-Jan-02	3	7.942	0.0008	0	0.0445
15	C	10-Jan-02	3	7.933	0.0019	0.01	0.1103
15	C	26-Jan-02	3	7.933	0.0009	0	0.0501
15	C	23-Jan-02	3	N/D	N/D	N/D	N/D
16	C	10-Jan-02	4	8.008	0.0013	0.01	0.0731

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
16	C	26-Jan-02	4	7.933	0.0008	0	0.0431
16	C	6-Jan-02	4	8.15	0	0	0.0006
17	C	10-Jan-02	4	8.025	0.0006	0	0.0354
17	C	26-Jan-02	4	7.95	0.0012	0	0.0663
17	C	23-Jan-02	4	N/D	N/D	N/D	N/D
18	C	10-Jan-02	4	8.058	0.0005	0	0.0309
18	C	26-Jan-02	4	8.183	0.0001	0	0.0048
18	C	23-Jan-02	4	N/D	N/D	N/D	N/D
19	C	16-Jan-02	3	7.983	0.0019	0.01	0.1093
19	C	10-Jan-02	3	8.042	0.002	0.01	0.1141
20	C	16-Jan-02	3	7.967	0.0012	0	0.0668
20	C	10-Jan-02	3	8.033	0.0009	0	0.0522
20	C	26-Jan-02	3	8.058	0.0001	0	0.0074
21	C	10-Jan-02	3	8.05	0.0146	0.06	0.8358
21	C	26-Jan-02	3	N/D	N/D	N/D	N/D
21	C	6-Jan-02	3	8.033	0.0003	0	0.0182
22	C	5-Jan-02	4	7.958	0	0	0.0018
22	C	10-Jan-02	4	8.025	0.002	0.01	0.1163
22	C	6-Jan-02	4	8.067	0.0004	0	0.0251
23	C	5-Jan-02	4	8.067	0.0003	0	0.0195
23	C	10-Jan-02	4	8.025	0	0	0.0008
23	C	6-Jan-02	4	8.058	0.001	0	0.0576
24	C	5-Jan-02	4	8.117	0.0002	0	0.0106
24	C	10-Jan-02	4	8.017	0.0006	0	0.0366
24	C	6-Jan-02	4	8.092	0.0009	0	0.049
25	C	5-Jan-02	5	8.125	0	0	0.0011
25	C	10-Jan-02	5	8.033	0.0004	0	0.0241
25	C	28-Jan-02	5	7.975	0.0002	0	0.0141
26	C	10-Jan-02	5	8.033	0.0011	0	0.0623
26	C	28-Jan-02	5	7.942	0.0017	0.01	0.0983
26	C	23-Jan-02	5	N/D	N/D	N/D	N/D
27	C	10-Jan-02	5	8.042	0.0008	0	0.0435
27	C	28-Jan-02	5	7.933	0.001	0	0.0555
27	C	23-Jan-02	5	N/D	N/D	N/D	N/D
28	C	5-Jan-02	6	8.067	0.0004	0.01	0.024
28	C	10-Jan-02	6	8.008	0.0002	0	0.0096
28	C	6-Jan-02	6	8.075	0.0008	0	0.0451
29	C	5-Jan-02	6	7.983	0.004	0.02	0.2267
29	C	10-Jan-02	6	8.05	0.0016	0	0.0891
29	C	6-Jan-02	6	8.092	0.0026	0.01	0.1458
30	C	5-Jan-02	6	8.025	0.002	0.01	0.116
30	C	10-Jan-02	6	8.05	0.0008	0	0.0454
30	C	6-Jan-02	6	8.058	0	0	0.0015
31	C	5-Jan-02	5	8	0.0022	0.01	0.1269

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
31	C	10-Jan-02	5	8.033	0.006	0.02	0.3437
31	C	28-Jan-02	5	7.933	0.0023	0.01	0.1339
32	C	10-Jan-02	5	8.033	0.0003	0	0.019
32	C	28-Jan-02	5	7.925	0.0011	0	0.06
32	C	23-Jan-02	5	N/D	N/D	N/D	N/D
33	C	10-Jan-02	5	8.017	0.0015	0.01	0.0883
33	C	28-Jan-02	5	7.975	0.0001	0	0.0079
33	C	23-Jan-02	5	N/D	N/D	N/D	N/D
34	C	5-Jan-02	8	8.033	0.0004	0	0.0238
34	C	10-Jan-02	8	8.025	0.0006	0	0.0318
34	C	6-Jan-02	8	8.075	0.0004	0	0.0243
35	C	5-Jan-02	8	8.042	0.0003	0	0.0153
35	C	10-Jan-02	8	8.025	0.0006	0	0.035
35	C	6-Jan-02	8	8.033	0.0004	0	0.0239
36	C	5-Jan-02	8	8.017	0.0022	0.01	0.125
36	C	10-Jan-02	8	8.025	0	0	0.0022
36	C	6-Jan-02	8	8.025	0.0003	0	0.0144
37	C	5-Jan-02	7	8.058	0.0005	0	0.0279
37	C	10-Jan-02	7	8.067	0.0008	0	0.0456
37	C	28-Jan-02	7	8	0	0	0.0005
37	C	6-Jan-02	7	8.05	0	0	0.002
38	C	10-Jan-02	7	8.025	0.0059	0.02	0.3385
38	C	28-Jan-02	7	7.917	0.0034	0.02	0.1922
38	C	6-Jan-02	7	8.042	0.0067	0.03	0.3809
39	C	10-Jan-02	7	8.017	0.0013	0.01	0.0755
39	C	28-Jan-02	7	7.942	0.001	0	0.0553
39	C	23-Jan-02	7	N/D	N/D	N/D	N/D
40	C	10-Jan-02	8	7.992	0.0007	0	0.0374
40	C	28-Jan-02	8	7.933	0.002	0.01	0.1158
40	C	23-Jan-02	8	N/D	N/D	N/D	N/D
41	C	10-Jan-02	8	8	0.0015	0.01	0.0879
41	C	28-Jan-02	8	7.942	0.0017	0.01	0.0993
41	C	6-Jan-02	8	8.1	0.0002	0	0.0118
42	C	10-Jan-02	8	7.992	0.0015	0.01	0.0846
42	C	28-Jan-02	8	7.925	0.0013	0.01	0.0752
42	C	23-Jan-02	8	N/D	N/D	N/D	N/D
43	C	10-Jan-02	9	7.967	0.0006	0	0.0365
43	C	28-Jan-02	9	7.908	0.0011	0	0.0623
43	C	6-Jan-02	9	8.05	0.0005	0	0.0286
44	C	10-Jan-02	9	8.008	0.0006	0	0.0352
44	C	28-Jan-02	9	7.917	0.0012	0.01	0.0709
44	C	23-Jan-02	9	N/D	N/D	N/D	N/D
45	C	10-Jan-02	9	8.008	0.0006	0	0.0339
45	C	28-Jan-02	9	7.908	0.0012	0.01	0.0696

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
45	C	23-Jan-02	9	N/D	N/D	N/D	N/D
46	C	28-Jan-02	10	7.925	0.0046	0.02	0.2621
46	C	10-Jan-02	10	8.125	0.0009	0	0.0541
46	C	23-Jan-02	10	N/D	N/D	N/D	N/D
47	C	28-Jan-02	10	7.933	0.0024	0.01	0.1392
47	C	10-Jan-02	10	8.1	0.0016	0.01	0.0905
47	C	23-Jan-02	10	N/D	N/D	N/D	N/D
48	C	28-Jan-02	10	7.933	0.0005	0	0.0273
48	C	10-Jan-02	10	8.042	0.0006	0	0.0332
48	C	6-Jan-02	10	8.092	0.0001	0	0.0044
49	C	28-Jan-02	11	7.925	0.0567	0.23	3.2384
49	C	10-Jan-02	11	8.075	0.013	0.05	0.7427
49	C	6-Jan-02	11	8.075	0.0007	0	0.0426
50	C	28-Jan-02	11	7.908	0.0007	0	0.0407
50	C	10-Jan-02	11	8.058	0.0012	0	0.066
50	C	6-Jan-02	11	8.058	0	0	0.001
51	C	28-Jan-02	11	7.917	0.0007	0	0.0417
51	C	10-Jan-02	11	8.058	0.0004	0	0.0249
51	C	6-Jan-02	11	8.075	0	0	0.0012
52	C	28-Jan-02	12	7.933	0.0003	0	0.0158
52	C	10-Jan-02	12	8.033	0.0005	0	0.0291
52	C	23-Jan-02	12	N/D	N/D	N/D	N/D
53	C	28-Jan-02	12	7.933	0.0059	0.02	0.3383
53	C	10-Jan-02	12	8.067	0.0009	0	0.0514
53	C	23-Jan-02	12	N/D	N/D	N/D	N/D
54	C	28-Jan-02	12	7.9	0.0003	0	0.015
54	C	10-Jan-02	12	8.042	0.0087	0.03	0.4949
54	C	23-Jan-02	12	N/D	N/D	N/D	N/D
55	C	28-Jan-02	13	7.925	0.005	0.02	0.2837
55	C	10-Jan-02	13	8.025	0.0003	0	0.0165
55	C	23-Jan-02	13	N/D	N/D	N/D	N/D
56	C	28-Jan-02	13	7.908	0.0004	0	0.0202
56	C	10-Jan-02	13	8.025	0.0015	0.01	0.0868
56	C	23-Jan-02	13	N/D	N/D	N/D	N/D
57	C	28-Jan-02	13	7.95	0.0005	0	0.0296
57	C	10-Jan-02	13	8.017	0.0005	0	0.0295
57	C	23-Jan-02	13	N/D	N/D	N/D	N/D
58	C	28-Jan-02	12	7.908	0.0013	0.01	0.0771
58	C	10-Jan-02	12	8.017	0.0017	0.01	0.0994
58	C	23-Jan-02	12	N/D	N/D	N/D	N/D
59	C	28-Jan-02	12	7.917	0.0015	0.01	0.0856
59	C	10-Jan-02	12	8.017	0.0012	0	0.067
59	C	23-Jan-02	12	N/D	N/D	N/D	N/D
60	C	28-Jan-02	12	7.917	0.0018	0.01	0.102

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
60	C	10-Jan-02	12	8.017	0.0007	0	0.0424
60	C	6-Jan-02	12	8.042	0.0011	0	0.0621
61	C	28-Jan-02	13	7.908	0.0008	0	0.0457
61	C	10-Jan-02	13	8.033	0.0016	0.01	0.0898
61	C	23-Jan-02	13	N/D	N/D	N/D	N/D
62	C	28-Jan-02	13	7.925	0.0009	0	0.0519
62*	C	10-Jan-02	13	8.042	0.0354	0.15	2.0243
62	C	23-Jan-02	13	N/D	N/D	N/D	N/D
63	C	28-Jan-02	13	7.908	0.0033	0.01	0.1867
63	C	10-Jan-02	13	8.033	0.0014	0.01	0.0785
63	C	23-Jan-02	13	N/D	N/D	N/D	N/D
64	C	28-Jan-02	14	7.917	0.0015	0.01	0.0879
64	C	10-Jan-02	14	8.033	0.001	0	0.0595
64	C	23-Jan-02	14	N/D	N/D	N/D	N/D
65	C	28-Jan-02	14	7.925	0.0024	0.01	0.1381
65	C	10-Jan-02	14	7.967	0.0012	0.01	0.0673
65	C	23-Jan-02	14	N/D	N/D	N/D	N/D
66*	C	28-Jan-02	14	7.925	0.0235	0.1	1.3447
66	C	10-Jan-02	14	8	0.0015	0.01	0.0833
66	C	23-Jan-02	14	N/D	N/D	N/D	N/D

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix AF: Lactate, Field Blanks, Influent and Effluent

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
Blank	BLANK	10-Jan-02	B	7.967	0.0102	0.04	0.5807
Blank	BLANK	26-Jan-02	B	7.975	0.0003	0	0.0171
Blank	BLANK	28-Jan-02	B	7.967	0.001	0	0.06
Influent	INFLUENT	5-Jan-02	I	8.033	0.0003	0	0.0178
Influent	INFLUENT	10-Jan-02	I	8.008	0.0004	0	0.023
Influent	INFLUENT	6-Jan-02	I	8.117	0.0001	0	0.0058
Effluent	EFFLUENT	5-Jan-02	E	8.017	0.0038	0.02	0.2196
Effluent	EFFLUENT	10-Jan-02	E	8.008	0.0017	0.01	0.0956
Effluent	EFFLUENT	6-Jan-02	E	7.983	0.001	0	0.0571

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix AG: Nitrate, Strata A

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	A	16-Jan-02	1	N/D	N/D	N/D	N/D
1	A	17-Jan-02	1	N/D	N/D	N/D	N/D
1	A	23-Jan-02	1	N/D	N/D	N/D	N/D
2	A	16-Jan-02	1	21.725	2.3376	4.93	13.0673
2	A	17-Jan-02	1	21.725	2.1444	4.64	11.9876
2	A	23-Jan-02	1	21.717	1.7627	4.17	9.8536
3	A	18-Jan-02	1	21.692	2.8058	5.55	15.6847
3	A	16-Jan-02	1	21.692	3.6502	6.17	20.4049
3	A	17-Jan-02	1	21.692	3.1801	5.98	17.777
4	A	18-Jan-02	2	21.717	2.4427	4.77	13.6549
4	A	16-Jan-02	2	21.717	2.2626	4.81	12.6482
4*	A	17-Jan-02	2	21.275	0.005	0.03	0.0282
5	A	18-Jan-02	2	21.692	2.9742	5.73	16.6259
5	A	16-Jan-02	2	21.692	3.0822	5.89	17.23
5	A	17-Jan-02	2	21.7	3.0096	5.78	16.824
6	A	18-Jan-02	2	21.708	2.4087	4.99	13.4648
6	A	16-Jan-02	2	21.708	2.8459	5.61	15.9088
6*	A	17-Jan-02	2	21.175	0.0002	0	0.0011
7	A	17-Jan-02	1	21.725	2.1342	4.63	11.9304
7	A	23-Jan-02	1	21.7	2.648	4.98	14.8028
8	A	18-Jan-02	1	21.692	3.0323	5.77	16.9511
8	A	16-Jan-02	1	21.692	3.3485	6.14	18.7184
8	A	17-Jan-02	1	21.7	2.852	5.51	15.9432
9	A	18-Jan-02	1	21.717	2.2806	4.54	12.7488
9	A	16-Jan-02	1	21.717	2.5889	4.97	14.472
9	A	17-Jan-02	1	N/D	N/D	N/D	N/D
10	A	18-Jan-02	2	N/D	N/D	N/D	N/D
10	A	10-Jan-02	2	21.725	1.3155	3.3	7.3537
10	A	16-Jan-02	2	N/D	N/D	N/D	N/D
10	A	14-Jan-02	2	N/D	N/D	N/D	N/D
11	A	18-Jan-02	2	21.692	3.0076	5.8	16.8126
11	A	10-Jan-02	2	21.692	3.4007	6.04	19.0101
11	A	16-Jan-02	2	21.7	2.8742	5.65	16.0671
11	A	14-Jan-02	2	21.708	3.0226	5.76	16.8967
12	A	18-Jan-02	2	21.692	2.9019	5.55	16.2218
12	A	10-Jan-02	2	21.708	2.8466	5.98	15.9128
12	A	16-Jan-02	2	21.692	3.1097	5.83	17.3837
13	A	18-Jan-02	3	21.7	2.6582	5.21	14.8594
13	A	16-Jan-02	3	21.708	2.8415	5.49	15.8845
13	A	17-Jan-02	3	21.708	2.6303	5.24	14.7035
14	A	18-Jan-02	3	21.692	3.2246	5.64	18.026
14	A	23-Jan-02	3	21.675	3.1638	5.96	17.6858
14	A	14-Jan-02	3	21.717	2.687	5.34	15.0208

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
15	A	18-Jan-02	3	21.7	2.7994	5.53	15.6492
15	A	17-Jan-02	3	21.717	2.2853	4.83	12.775
15	A	23-Jan-02	3	21.692	2.5799	5.28	14.422
16	A	18-Jan-02	4	N/D	N/D	N/D	N/D
16	A	10-Jan-02	4	N/D	N/D	N/D	N/D
16	A	23-Jan-02	4	N/D	N/D	N/D	N/D
17	A	17-Jan-02	4	21.7	3.3345	5.79	18.6402
17	A	18-Jan-02	4	21.675	3.3887	5.86	18.9431
17	A	23-Jan-02	4	21.675	3.3859	5.9	18.9276
18	A	18-Jan-02	4	21.675	3.3506	5.72	18.73
18	A	23-Jan-02	4	21.675	2.9027	5.68	16.2266
18	A	14-Jan-02	4	N/D	N/D	N/D	N/D
19	A	17-Jan-02	3	21.7	2.8038	5.47	15.6735
19	A	18-Jan-02	3	21.667	2.9701	5.79	16.6032
19	A	24-Jan-02	3	21.675	3.1518	5.98	17.6189
20	A	10-Jan-02	3	N/D	N/D	N/D	N/D
20	A	18-Jan-02	3	N/D	N/D	N/D	N/D
20	A	23-Jan-02	3	N/D	N/D	N/D	N/D
21	A	10-Jan-02	3	N/D	N/D	N/D	N/D
21	A	18-Jan-02	3	21.708	2.0423	4.5	11.4169
21	A	23-Jan-02	3	21.708	1.9864	4.45	11.1039
22	A	10-Jan-02	4	N/D	N/D	N/D	N/D
22	A	18-Jan-02	4	N/D	N/D	N/D	N/D
22	A	23-Jan-02	4	N/D	N/D	N/D	N/D
23	A	10-Jan-02	4	21.717	3.2429	6.14	18.128
23	A	18-Jan-02	4	21.675	3.1437	5.96	17.5738
23	A	14-Jan-02	4	N/D	N/D	N/D	N/D
24	A	10-Jan-02	4	21.717	3.1085	5.86	17.3767
24	A	18-Jan-02	4	21.692	3.1687	5.63	17.7134
24	A	14-Jan-02	4	21.717	2.6877	5.36	15.0246
25*	A	10-Jan-02	5	21.242	0.0003	0	0.0018
25	A	18-Jan-02	5	21.725	1.7551	4.05	9.811
25	A	23-Jan-02	5	21.725	1.6552	3.89	9.2528
26	A	17-Jan-02	5	21.7	2.898	5.63	16.2002
26	A	18-Jan-02	5	21.675	2.823	5.63	15.7807
26	A	23-Jan-02	5	21.683	2.729	5.42	15.2553
27	A	18-Jan-02	5	21.675	3.2187	5.67	17.9931
27	A	23-Jan-02	5	21.692	2.7981	5.19	15.6419
27	A	14-Jan-02	5	21.725	2.3562	4.96	13.1713
28	A	10-Jan-02	6	21.717	3.7172	6.56	20.7795
28	A	18-Jan-02	6	21.658	3.7703	6.64	21.0762
28	A	23-Jan-02	6	21.675	3.789	6.36	21.1809
29*	A	10-Jan-02	6	21.558	0.0776	0.45	0.4338
29*	A	18-Jan-02	6	21.475	0.0895	0.62	0.5



Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
29*	A	23-Jan-02	6	21.442	0.0813	0.6	0.4547
30	A	10-Jan-02	6	N/D	N/D	N/D	N/D
30	A	18-Jan-02	6	N/D	N/D	N/D	N/D
30	A	24-Jan-02	6	21.433	0.4839	2.4	2.7048
31	A	10-Jan-02	5	21.708	3.4844	6.43	19.4784
31	A	18-Jan-02	5	21.667	3.1405	5.97	17.556
31	A	14-Jan-02	5	21.725	2.3348	4.9	13.0519
32	A	17-Jan-02	5	21.7	2.8807	5.73	16.1033
32	A	18-Jan-02	5	21.675	2.9492	5.66	16.4861
32	A	23-Jan-02	5	21.675	3.0713	5.93	17.1691
33	A	18-Jan-02	5	21.717	1.8084	4.12	10.1091
33	A	23-Jan-02	5	21.717	1.7958	4.11	10.0387
33	A	14-Jan-02	5	N/D	N/D	N/D	N/D
34	A	22-Jan-02	8	21.692	2.7382	5.45	15.3069
34	A	10-Jan-02	8	N/D	N/D	N/D	N/D
34	A	24-Jan-02	8	21.692	2.7392	5.46	15.3124
35	A	22-Jan-02	8	21.717	1.6434	3.82	9.1868
35	A	10-Jan-02	8	N/D	N/D	N/D	N/D
35	A	24-Jan-02	8	N/D	N/D	N/D	N/D
36	A	17-Jan-02	8	N/D	N/D	N/D	N/D
36	A	22-Jan-02	8	21.708	1.8758	4.03	10.4861
36	A	24-Jan-02	8	21.725	1.8	3.99	10.062
37	A	22-Jan-02	7	21.725	1.4922	3.59	8.3418
37	A	10-Jan-02	7	N/D	N/D	N/D	N/D
37	A	24-Jan-02	7	N/D	N/D	N/D	N/D
38	A	22-Jan-02	7	21.675	2.9762	5.49	16.6373
38	A	10-Jan-02	7	21.725	2.9741	5.8	16.6257
38	A	24-Jan-02	7	21.683	3.0969	5.52	17.312
39	A	17-Jan-02	7	21.692	3.0766	5.82	17.1987
39	A	22-Jan-02	7	21.675	3.2177	6.01	17.9873
39	A	24-Jan-02	7	21.683	2.8486	5.5	15.924
40	A	17-Jan-02	8	21.683	3.3023	6.06	18.4604
40	A	22-Jan-02	8	21.658	3.2894	6.06	18.3884
40	A	24-Jan-02	8	21.675	3.3252	6.1	18.5883
41	A	22-Jan-02	8	21.658	3.0951	5.91	17.3017
41	A	10-Jan-02	8	21.725	3.1918	6.05	17.8424
41	A	24-Jan-02	8	21.683	2.8914	5.66	16.1632
42	A	17-Jan-02	8	21.692	3.4451	6.02	19.2584
42	A	22-Jan-02	8	21.658	3.5299	6.11	19.7327
42	A	24-Jan-02	8	21.683	3.0207	5.79	16.8863
43	A	22-Jan-02	9	21.667	3.1587	5.65	17.6576
43	A	10-Jan-02	9	21.725	3.2023	5.8	17.9014
43	A	14-Jan-02	9	21.717	2.6916	5.13	15.0461
44	A	22-Jan-02	9	21.658	3.2965	6.1	18.4277

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
44	A	10-Jan-02	9	21.708	3.2222	6.05	18.0123
44	A	14-Jan-02	9	21.692	3.6405	6.53	20.3508
45	A	22-Jan-02	9	21.667	2.6156	5.36	14.6215
45	A	10-Jan-02	9	N/D	N/D	N/D	N/D
45	A	24-Jan-02	9	21.683	2.6761	5.41	14.9595
46	A	17-Jan-02	10	21.692	3.3887	5.82	18.9432
46	A	22-Jan-02	10	21.658	3.5477	6.02	19.8321
46	A	24-Jan-02	10	21.683	3.1056	5.51	17.3607
47	A	17-Jan-02	10	21.683	3.1487	5.88	17.6013
47	A	22-Jan-02	10	21.658	3.2023	6	17.901
47	A	24-Jan-02	10	21.683	2.962	5.69	16.5576
48	A	22-Jan-02	10	21.683	2.4549	5.1	13.7233
48*	A	10-Jan-02	10	21.275	0.0017	0.03	0.0095
48	A	14-Jan-02	10	N/D	N/D	N/D	N/D
49	A	22-Jan-02	11	21.667	3.3775	5.83	18.8804
49	A	10-Jan-02	11	21.725	3.3173	5.81	18.5438
49	A	24-Jan-02	11	N/D	N/D	N/D	N/D
50	A	22-Jan-02	11	21.675	2.6326	5.36	14.7165
50	A	10-Jan-02	11	N/D	N/D	N/D	N/D
50	A	24-Jan-02	11	N/D	N/D	N/D	N/D
51	A	22-Jan-02	11	21.667	3.1421	5.99	17.5645
51	A	10-Jan-02	11	21.725	3.1541	6.02	17.6318
51	A	24-Jan-02	11	N/D	N/D	N/D	N/D
52	A	17-Jan-02	12	N/D	N/D	N/D	N/D
52	A	22-Jan-02	12	21.7	1.873	4.22	10.4705
52	A	24-Jan-02	12	N/D	N/D	N/D	N/D
53	A	17-Jan-02	12	N/D	N/D	N/D	N/D
53	A	22-Jan-02	12	21.717	1.5034	3.6	8.4042
53	A	24-Jan-02	12	N/D	N/D	N/D	N/D
54	A	22-Jan-02	12	21.65	3.4643	6.31	19.3658
54	A	10-Jan-02	12	21.725	3.2521	6.03	18.1793
54	A	24-Jan-02	12	N/D	N/D	N/D	N/D
55	A	22-Jan-02	13	21.675	2.7154	5.45	15.1794
55	A	10-Jan-02	13	N/D	N/D	N/D	N/D
55	A	24-Jan-02	13	N/D	N/D	N/D	N/D
56	A	17-Jan-02	13	21.725	1.8302	4.5	10.2311
56	A	22-Jan-02	13	21.683	1.9406	4.7	10.8481
56	A	24-Jan-02	13	N/D	N/D	N/D	N/D
57	A	22-Jan-02	13	21.683	2.3317	4.96	13.0347
57	A	10-Jan-02	13	N/D	N/D	N/D	N/D
57	A	24-Jan-02	13	N/D	N/D	N/D	N/D
58	A	22-Jan-02	12	21.683	2.2907	4.84	12.8051
58	A	10-Jan-02	12	N/D	N/D	N/D	N/D
58	A	24-Jan-02	12	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
59	A	22-Jan-02	12	21.658	3.0393	5.83	16.9903
59	A	10-Jan-02	12	21.725	3.1013	5.92	17.3364
59	A	24-Jan-02	12	N/D	N/D	N/D	N/D
60	A	22-Jan-02	12	21.667	2.9705	5.75	16.6052
60	A	10-Jan-02	12	21.725	3.0688	5.89	17.155
60	A	14-Jan-02	12	21.717	2.5043	5.08	13.9995
61	A	22-Jan-02	13	21.675	2.95	5.71	16.4909
61	A	10-Jan-02	13	21.725	2.8832	5.7	16.1175
61*	A	14-Jan-02	13	21.158	0.0004	0.01	0.0022
62	A	22-Jan-02	13	21.675	2.7871	5.5	15.5804
62	A	10-Jan-02	13	N/D	N/D	N/D	N/D
62	A	24-Jan-02	13	N/D	N/D	N/D	N/D
63*	A	22-Jan-02	13	21.158	0.0002	0	0.0009
63*	A	10-Jan-02	13	21.233	0.0042	0.03	0.0235
63	A	14-Jan-02	13	21.708	3.0672	5.57	17.1458
64	A	22-Jan-02	14	21.683	2.5075	5.18	14.0172
64	A	10-Jan-02	14	N/D	N/D	N/D	N/D
64	A	24-Jan-02	14	N/D	N/D	N/D	N/D
65	A	17-Jan-02	14	N/D	N/D	N/D	N/D
65	A	22-Jan-02	14	21.717	1.4931	3.58	8.3465
65	A	24-Jan-02	14	N/D	N/D	N/D	N/D
66*	A	17-Jan-02	14	21.225	0.0042	0.03	0.0233
66	A	23-Jan-02	14	21.667	3.0623	5.9	17.1187
66	A	24-Jan-02	14	N/D	N/D	N/D	N/D

\*—JMP 4.0 Outlier

N/D—Not Detected

**Appendix AH: Nitrate, Strata B**

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (µS*min)	Height (µS)	Amount (ppm)
1	B	25-Jan-02	1	21.7	2.0953	4.51	11.7128
1	B	17-Jan-02	1	21.717	2.0689	4.49	11.5655
1	B	15-Jan-02	1	21.725	2.1892	4.78	12.2377
2	B	25-Jan-02	1	21.675	2.6118	5.79	14.6001
2	B	13-Jan-02	1	21.708	2.9053	6.26	16.2412
2	B	15-Jan-02	1	21.683	2.7333	6.02	15.2797
3	B	25-Jan-02	1	21.708	1.9739	4.4	11.0342
3*	B	13-Jan-02	1	21.267	0.0061	0.05	0.0344
3	B	15-Jan-02	1	21.725	2.1359	4.66	11.9397
4	B	25-Jan-02	2	21.717	1.5631	3.72	8.7381
4	B	13-Jan-02	2	N/D	N/D	N/D	N/D
4	B	15-Jan-02	2	N/D	N/D	N/D	N/D
5	B	25-Jan-02	2	21.675	2.9159	5.71	16.3
5	B	17-Jan-02	2	21.692	2.9214	5.67	16.3309
5	B	15-Jan-02	2	21.692	3.3344	5.92	18.6396
6	B	25-Jan-02	2	21.675	2.8902	5.69	16.1567
6	B	13-Jan-02	2	21.708	3.3021	5.88	18.4589
6	B	15-Jan-02	2	21.7	3.3238	5.89	18.5806
7	B	25-Jan-02	1	21.683	2.3717	4.97	13.258
7	B	17-Jan-02	1	21.708	2.3993	4.94	13.4123
7	B	15-Jan-02	1	21.708	2.5697	5.27	14.365
8	B	25-Jan-02	1	21.675	2.782	5.51	15.5518
8*	B	13-Jan-02	1	21.242	0	0	0.0001
8	B	15-Jan-02	1	21.708	2.9016	5.71	16.2202
9	B	25-Jan-02	1	N/D	N/D	N/D	N/D
9	B	13-Jan-02	1	N/D	N/D	N/D	N/D
9	B	15-Jan-02	1	N/D	N/D	N/D	N/D
10*	B	25-Jan-02	2	21.425	0.4407	2.19	2.4633
10*	B	13-Jan-02	2	21.5	0.4085	2.14	2.2837
10*	B	15-Jan-02	2	21.492	0.4326	2.26	2.4182
11	B	25-Jan-02	2	21.667	2.7979	5.53	15.6405
11	B	13-Jan-02	2	21.708	2.9992	5.86	16.7659
11	B	15-Jan-02	2	21.692	3.0034	5.85	16.7893
12	B	25-Jan-02	2	21.667	3.2706	6.12	18.2829
12	B	13-Jan-02	2	21.7	3.4541	6.4	19.3087
12	B	15-Jan-02	2	21.692	3.4052	6.32	19.0352
13	B	17-Jan-02	3	21.692	3.1025	5.82	17.3431
14	B	25-Jan-02	3	21.667	3.11	5.91	17.3854
14	B	13-Jan-02	3	21.7	3.301	6.2	18.4529
14	B	15-Jan-02	3	21.7	3.1862	6.07	17.8113
15	B	25-Jan-02	3	21.675	3.0742	5.83	17.185
15	B	13-Jan-02	3	21.7	3.4419	6.24	19.2406

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
15	B	15-Jan-02	3	21.692	3.3113	6.09	18.5108
16	B	25-Jan-02	4	21.692	2.3416	4.94	13.0901
16	B	13-Jan-02	4	21.717	2.4302	5.09	13.585
16	B	15-Jan-02	4	21.717	2.3632	5	13.2106
17	B	25-Jan-02	4	21.667	3.1711	5.91	17.7271
17	B	17-Jan-02	4	21.692	2.9879	5.67	16.7027
17	B	15-Jan-02	4	21.692	3.1904	6.02	17.8349
18	B	25-Jan-02	4	21.667	3.2062	5.96	17.923
18	B	17-Jan-02	4	21.683	3.2513	5.95	18.175
18	B	15-Jan-02	4	21.692	3.4462	6.29	19.2645
19	B	25-Jan-02	3	21.658	3.1639	5.97	17.6866
19	B	17-Jan-02	3	21.683	3.3745	6.21	18.8639
19	B	16-Jan-02	3	21.683	3.4307	5.94	19.1779
20	B	25-Jan-02	3	21.7	1.7805	4.04	9.953
20	B	13-Jan-02	3	N/D	N/D	N/D	N/D
20	B	15-Jan-02	3	N/D	N/D	N/D	N/D
21	B	25-Jan-02	3	21.7	2.0014	4.42	11.1879
21	B	13-Jan-02	3	N/D	N/D	N/D	N/D
21	B	15-Jan-02	3	N/D	N/D	N/D	N/D
22	B	25-Jan-02	4	21.708	1.5068	3.61	8.4231
22	B	13-Jan-02	4	N/D	N/D	N/D	N/D
22	B	15-Jan-02	4	N/D	N/D	N/D	N/D
23	B	25-Jan-02	4	21.683	2.3077	4.87	12.9002
23	B	13-Jan-02	4	21.725	2.1768	5.11	12.1684
23*	B	15-Jan-02	4	21.217	0.0052	0.04	0.0291
24	B	25-Jan-02	4	21.675	2.7315	5.31	15.2691
24	B	13-Jan-02	4	21.7	3.2789	6.02	18.3296
24	B	15-Jan-02	4	21.7	3.0089	5.7	16.8199
25	B	25-Jan-02	5	21.675	2.6104	5.31	14.5926
25	B	13-Jan-02	5	21.708	2.9562	5.8	16.5252
25	B	15-Jan-02	5	21.7	3.0204	5.88	16.8845
26	B	25-Jan-02	5	21.675	3.0603	5.44	17.1077
26	B	13-Jan-02	5	21.7	3.5824	6.12	20.0262
26	B	15-Jan-02	5	21.692	3.5098	6.07	19.6201
27	B	25-Jan-02	5	21.667	3.119	5.85	17.4356
27	B	13-Jan-02	5	21.7	3.3291	6.17	18.6099
27	B	15-Jan-02	5	21.692	3.468	6.26	19.3863
28	B	25-Jan-02	6	21.667	2.6436	5.31	14.778
28	B	13-Jan-02	6	21.7	3.1122	5.97	17.3975
28	B	15-Jan-02	6	21.7	3.0149	5.87	16.8539
29	B	25-Jan-02	6	21.725	1.3243	3.27	7.4031
29	B	13-Jan-02	6	N/D	N/D	N/D	N/D
29	B	15-Jan-02	6	N/D	N/D	N/D	N/D
30	B	25-Jan-02	6	21.675	2.9422	5.36	16.4475

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
30	B	13-Jan-02	6	21.708	2.6927	5.45	15.0525
30	B	15-Jan-02	6	21.7	2.7966	5.57	15.6332
31	B	25-Jan-02	5	21.667	2.7882	5.47	15.5864
31	B	13-Jan-02	5	21.7	2.9741	5.79	16.6257
31	B	15-Jan-02	5	21.7	2.8451	5.61	15.9044
32	B	13-Jan-02	5	21.708	3.0151	5.86	16.8548
32*	B	15-Jan-02	5	21.25	0.0023	0.04	0.0126
32	B	16-Jan-02	5	21.683	3.0209	5.9	16.8873
33	B	25-Jan-02	5	21.717	1.5715	3.71	8.7847
33	B	13-Jan-02	5	N/D	N/D	N/D	N/D
33	B	15-Jan-02	5	N/D	N/D	N/D	N/D
34	B	16-Jan-02	8	21.692	3.1071	5.95	17.369
34	B	26-Jan-02	8	21.675	2.9406	5.73	16.438
34	B	13-Jan-02	8	21.717	3.0604	5.92	17.1079
35	B	16-Jan-02	8	N/D	N/D	N/D	N/D
35	B	26-Jan-02	8	21.717	1.6961	3.92	9.4813
35	B	13-Jan-02	8	N/D	N/D	N/D	N/D
36*	B	16-Jan-02	8	21.258	0.0041	0.04	0.0227
36	B	26-Jan-02	8	21.683	2.508	5.12	14.0197
36*	B	13-Jan-02	8	21.258	0.006	0.05	0.0334
37*	B	26-Jan-02	7	21.192	0.0022	0.04	0.0126
37	B	13-Jan-02	7	21.717	2.9629	5.8	16.5631
37	B	23-Jan-02	7	21.675	2.9848	5.83	16.6851
38	B	16-Jan-02	7	21.692	2.9043	5.72	16.2356
38	B	26-Jan-02	7	21.667	3.2583	5.74	18.2142
38	B	13-Jan-02	7	21.717	3.2046	5.65	17.9139
39	B	16-Jan-02	7	21.692	3.4275	6	19.1604
39	B	26-Jan-02	7	21.667	3.0679	5.87	17.1497
39	B	13-Jan-02	7	21.708	3.1599	6.05	17.6643
40	B	16-Jan-02	8	21.683	3.3044	6.11	18.4718
40	B	26-Jan-02	8	21.667	3.1298	5.87	17.496
40	B	13-Jan-02	8	21.708	3.2117	6	17.9538
41	B	16-Jan-02	8	21.683	3.5171	6.09	19.6608
41	B	26-Jan-02	8	21.667	2.9865	5.74	16.6947
41	B	13-Jan-02	8	21.717	3.1899	6.04	17.8319
42	B	16-Jan-02	8	21.692	3.0035	5.86	16.7902
42	B	26-Jan-02	8	21.667	2.9029	5.68	16.2276
42	B	13-Jan-02	8	21.717	2.9854	5.82	16.6885
43	B	16-Jan-02	9	21.683	3.4891	6.32	19.5042
43	B	26-Jan-02	9	21.658	3.3304	6.1	18.6173
43	B	13-Jan-02	9	21.708	3.585	6.14	20.0407
44	B	16-Jan-02	9	21.692	2.9377	5.75	16.422
44	B	26-Jan-02	9	21.667	2.9869	5.69	16.6969
44	B	13-Jan-02	9	21.717	2.8192	5.54	15.7595

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
45	B	16-Jan-02	9	21.692	2.9433	5.76	16.4535
45	B	26-Jan-02	9	21.675	3.0873	5.41	17.2583
45	B	13-Jan-02	9	21.717	2.8396	5.61	15.8735
46	B	16-Jan-02	10	21.683	3.9136	6.26	21.8773
46	B	26-Jan-02	10	21.667	3.3551	6.1	18.7552
46	B	13-Jan-02	10	21.708	3.3779	6.15	18.8831
47	B	16-Jan-02	10	21.683	3.3896	6.18	18.9482
47	B	26-Jan-02	10	21.667	3.2017	5.93	17.8979
47	B	13-Jan-02	10	21.708	3.2812	6.06	18.3422
48	B	15-Jan-02	10	N/D	N/D	N/D	N/D
48	B	16-Jan-02	10	21.7	2.6224	5.34	14.6597
48	B	13-Jan-02	10	N/D	N/D	N/D	N/D
49	B	16-Jan-02	11	21.683	3.2473	6.1	18.1528
49	B	26-Jan-02	11	21.658	3.3828	5.82	18.91
49	B	13-Jan-02	11	21.708	3.515	6.08	19.6493
50	B	26-Jan-02	11	21.667	2.9054	5.61	16.2417
50	B	13-Jan-02	11	21.708	3.0237	5.78	16.9029
50	B	23-Jan-02	11	21.675	3.738	6.1	20.8959
51	B	16-Jan-02	11	21.708	2.3313	4.93	13.0321
51	B	26-Jan-02	11	21.692	2.4724	4.7	13.8209
51	B	13-Jan-02	11	N/D	N/D	N/D	N/D
52	B	16-Jan-02	12	21.7	2.6684	5.09	14.9165
52	B	26-Jan-02	12	21.7	2.1045	4.51	11.7643
52	B	13-Jan-02	12	21.725	2.6714	5.11	14.9336
53*	B	16-Jan-02	12	21.275	0.0062	0.04	0.0346
53	B	26-Jan-02	12	21.692	2.1966	4.68	12.2794
53	B	13-Jan-02	12	N/D	N/D	N/D	N/D
54	B	16-Jan-02	12	21.692	3.0028	5.8	16.7859
54	B	26-Jan-02	12	21.667	2.925	5.68	16.3512
54	B	13-Jan-02	12	21.717	2.989	5.79	16.7091
55	B	16-Jan-02	13	21.692	3.043	5.79	17.0107
55	B	26-Jan-02	13	21.658	3.0007	5.83	16.7743
55	B	13-Jan-02	13	21.708	3.1539	5.95	17.6307
56	B	15-Jan-02	13	21.725	2.2139	4.64	12.3758
56	B	16-Jan-02	13	21.7	2.6855	5.29	15.0123
57*	B	16-Jan-02	13	21.25	0.0021	0.03	0.0116
57	B	26-Jan-02	13	21.683	2.3117	4.83	12.9225
57	B	13-Jan-02	13	N/D	N/D	N/D	N/D
58	B	16-Jan-02	12	N/D	N/D	N/D	N/D
58	B	26-Jan-02	12	21.708	1.7192	3.95	9.6105
58	B	13-Jan-02	12	N/D	N/D	N/D	N/D
59	B	16-Jan-02	12	21.683	3.2232	6.02	18.0183
59	B	26-Jan-02	12	21.667	2.9257	5.65	16.3553
59	B	13-Jan-02	12	21.725	3.2387	5.76	18.1046

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
60	B	16-Jan-02	12	21.675	3.568	6.37	19.9458
60	B	26-Jan-02	12	21.667	2.9594	5.61	16.5433
60	B	13-Jan-02	12	21.7	3.4745	6.33	19.4228
61	B	16-Jan-02	13	21.683	3.386	6.2	18.9283
61	B	26-Jan-02	13	21.667	3.0196	5.68	16.8798
61	B	13-Jan-02	13	21.708	3.2932	6.25	18.4094
62	B	16-Jan-02	13	21.692	3.2788	6.03	18.3289
62	B	26-Jan-02	13	21.675	2.9606	5.61	16.5503
62	B	13-Jan-02	13	21.717	3.1439	5.89	17.575
63	B	16-Jan-02	13	21.683	3.2595	6	18.2208
63	B	26-Jan-02	13	21.667	3.1696	5.9	17.7183
63	B	13-Jan-02	13	21.717	3.0865	5.84	17.254
64	B	16-Jan-02	14	21.708	2.8087	5.25	15.7009
64	B	26-Jan-02	14	21.683	2.6738	5.05	14.9466
64	B	13-Jan-02	14	21.717	2.6965	5.42	15.0736
65*	B	16-Jan-02	14	21.208	0.0066	0.03	0.037
65	B	26-Jan-02	14	21.7	1.9186	4.28	10.7254
65	B	13-Jan-02	14	N/D	N/D	N/D	N/D
66	B	16-Jan-02	14	21.692	2.8863	5.67	16.1345
66	B	26-Jan-02	14	21.683	2.6898	5.34	15.0361
66	B	13-Jan-02	14	21.717	3.0708	5.88	17.1661

\*—JMP 4.0 Outlier

N/D—Not Detected



### Appendix AI: Nitrate, Strata C

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	C	16-Jan-02	1	21.492	0.4591	2.39	2.5666
1	C	17-Jan-02	1	21.475	0.5272	2.6	2.947
1	C	26-Jan-02	1	21.433	0.4993	2.48	2.7913
2	C	16-Jan-02	1	21.5	0.072	0.47	0.4026
2	C	17-Jan-02	1	21.483	0.417	2.12	2.3311
2	C	26-Jan-02	1	21.442	0.0743	0.51	0.4153
3	C	16-Jan-02	1	N/D	N/D	N/D	N/D
3	C	17-Jan-02	1	21.483	0.0773	0.53	0.4321
3	C	26-Jan-02	1	21.433	0.0749	0.56	0.4188
4	C	16-Jan-02	2	N/D	N/D	N/D	N/D
4	C	17-Jan-02	2	21.483	0.0729	0.5	0.4073
4	C	26-Jan-02	2	21.442	0.072	0.52	0.4022
5	C	16-Jan-02	2	N/D	N/D	N/D	N/D
5	C	17-Jan-02	2	21.483	0.0732	0.51	0.409
5	C	26-Jan-02	2	21.442	0.0862	0.61	0.4817
7	C	16-Jan-02	1	21.475	0.3886	2.01	2.1723
7	C	26-Jan-02	1	21.425	0.3993	2.02	2.232
7	C	22-Jan-02	1	21.458	0.3974	2.07	2.2215
8	C	26-Jan-02	1	21.425	0.4249	2.12	2.3752
8	C	23-Jan-02	1	21.45	0.4028	2.06	2.2516
8	C	22-Jan-02	1	21.458	0.3977	2.06	2.2229
9	C	16-Jan-02	1	21.483	0.3858	2.01	2.1569
9	C	26-Jan-02	1	21.425	0.413	2.06	2.3089
9	C	22-Jan-02	1	21.458	0.4427	2.27	2.4746
10	C	16-Jan-02	2	21.483	0.3957	2.09	2.2119
10	C	26-Jan-02	2	21.425	0.4309	2.15	2.4089
10	C	6-Jan-02	2	21.433	0.3328	1.71	1.8602
11	C	16-Jan-02	2	N/D	N/D	N/D	N/D
11	C	26-Jan-02	2	21.433	0.3569	1.86	1.9948
11	C	6-Jan-02	2	21.525	0.3616	1.94	2.0213
12	C	16-Jan-02	2	N/D	N/D	N/D	N/D
12*	C	26-Jan-02	2	21.717	1.4087	3.15	7.8746
12	C	23-Jan-02	2	N/D	N/D	N/D	N/D
13	C	16-Jan-02	3	N/D	N/D	N/D	N/D
13	C	10-Jan-02	3	21.408	0.3436	1.74	1.9206
13*	C	26-Jan-02	3	21.717	1.4442	3.11	8.0733
14	C	10-Jan-02	3	21.467	0.5562	2.7	3.1093
14	C	26-Jan-02	3	21.417	0.567	2.77	3.1694
14	C	23-Jan-02	3	21.433	0.5726	2.8	3.2011
15	C	10-Jan-02	3	21.492	0.5449	2.69	3.0461
15	C	26-Jan-02	3	21.417	0.5534	2.67	3.0933
15	C	23-Jan-02	3	21.442	0.5777	2.82	3.2293
16	C	10-Jan-02	4	21.5	0.5385	2.64	3.0105

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
16	C	26-Jan-02	4	21.417	0.5791	2.81	3.2371
16	C	6-Jan-02	4	21.55	0.4944	2.45	2.764
17	C	10-Jan-02	4	21.517	0.4839	2.4	2.7052
17	C	26-Jan-02	4	21.425	0.5369	2.6	3.0011
17	C	23-Jan-02	4	21.442	0.5364	2.63	2.9986
18	C	10-Jan-02	4	21.525	0.0737	0.5	0.4122
18	C	26-Jan-02	4	21.425	0.4054	2.04	2.2665
18	C	23-Jan-02	4	21.442	0.4086	2.07	2.2843
19	C	16-Jan-02	3	21.483	0.3457	1.88	1.9328
19	C	10-Jan-02	3	N/D	N/D	N/D	N/D
20	C	16-Jan-02	3	21.475	0.3726	2	2.0826
20	C	10-Jan-02	3	21.508	0.6327	3.07	3.5368
20	C	26-Jan-02	3	21.45	0.5699	2.66	3.1859
21	C	10-Jan-02	3	21.525	0.6015	2.99	3.3622
21	C	26-Jan-02	3	N/D	N/D	N/D	N/D
21	C	6-Jan-02	3	21.558	0.5864	2.87	3.2778
22	C	5-Jan-02	4	21.308	0.5533	2.66	3.0932
22	C	10-Jan-02	4	21.517	0.5893	2.93	3.2943
22	C	6-Jan-02	4	21.567	0.578	2.93	3.2311
23	C	5-Jan-02	4	21.475	0.5339	2.56	2.9843
23	C	10-Jan-02	4	21.525	0.5478	2.78	3.0622
23	C	6-Jan-02	4	21.567	0.5388	2.67	3.0118
24	C	5-Jan-02	4	21.525	0.5422	2.72	3.0309
24	C	10-Jan-02	4	21.525	0.5569	2.81	3.1131
24	C	6-Jan-02	4	21.575	0.5283	2.64	2.9532
25*	C	5-Jan-02	5	21.125	0.0005	0.01	0.0029
25	C	10-Jan-02	5	21.55	0.0739	0.43	0.4132
25	C	28-Jan-02	5	21.442	0.1826	1.02	1.021
26	C	10-Jan-02	5	21.517	0.5531	2.78	3.0919
26	C	28-Jan-02	5	21.425	0.5973	2.91	3.3388
26	C	23-Jan-02	5	21.433	0.6173	3	3.4509
27	C	10-Jan-02	5	21.517	0.5738	2.87	3.2075
27	C	28-Jan-02	5	21.425	0.6138	2.95	3.4315
27	C	23-Jan-02	5	21.433	0.6264	3.05	3.5016
28	C	5-Jan-02	6	21.567	0.5207	2.72	2.9106
28	C	10-Jan-02	6	21.525	0.5364	2.7	2.9986
28	C	6-Jan-02	6	21.575	0.51	2.56	2.8511
29	C	5-Jan-02	6	N/D	N/D	N/D	N/D
29	C	10-Jan-02	6	N/D	N/D	N/D	N/D
29	C	6-Jan-02	6	N/D	N/D	N/D	N/D
30	C	5-Jan-02	6	21.575	0.5058	2.61	2.8277
30	C	10-Jan-02	6	21.517	0.5725	2.89	3.2006
30	C	6-Jan-02	6	21.567	0.6359	3.14	3.5545
31*	C	5-Jan-02	5	21.167	0.0034	0.03	0.0189

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
31	C	10-Jan-02	5	21.542	0.0892	0.56	0.4985
31	C	28-Jan-02	5	21.425	0.6304	3.05	3.524
32	C	10-Jan-02	5	21.525	0.5921	2.91	3.3097
32	C	28-Jan-02	5	21.417	0.6086	2.94	3.4024
32	C	23-Jan-02	5	21.442	0.6193	2.99	3.462
33	C	10-Jan-02	5	21.525	0.5839	2.87	3.2643
33	C	28-Jan-02	5	21.417	0.5995	2.92	3.3511
33	C	23-Jan-02	5	21.442	0.6221	3.02	3.4778
34	C	5-Jan-02	8	21.583	0.5508	2.79	3.0791
34	C	10-Jan-02	8	21.517	0.599	2.92	3.3487
34	C	6-Jan-02	8	21.575	0.5351	2.72	2.991
35	C	5-Jan-02	8	21.575	0.5881	2.91	3.2875
35	C	10-Jan-02	8	21.517	0.5864	2.88	3.2781
35	C	6-Jan-02	8	21.567	0.5719	2.8	3.1969
36	C	5-Jan-02	8	21.583	0.5218	2.7	2.9171
36	C	10-Jan-02	8	21.525	0.5756	2.88	3.2179
36	C	6-Jan-02	8	21.567	0.5551	2.83	3.103
37*	C	5-Jan-02	7	21.2	0.0028	0.04	0.0156
37	C	10-Jan-02	7	N/D	N/D	N/D	N/D
37	C	28-Jan-02	7	N/D	N/D	N/D	N/D
37*	C	6-Jan-02	7	21.158	0	0	0.0001
38	C	10-Jan-02	7	21.517	0.6117	3.01	3.4193
38	C	28-Jan-02	7	21.417	0.642	3.06	3.5888
38	C	6-Jan-02	7	21.567	0.6381	3.11	3.5668
39	C	10-Jan-02	7	21.517	0.6078	2.97	3.3979
39	C	28-Jan-02	7	21.425	0.3738	1.91	2.0898
39	C	23-Jan-02	7	21.433	0.6263	3	3.501
40	C	10-Jan-02	8	21.517	0.6266	3.01	3.5028
40	C	28-Jan-02	8	21.425	0.6065	2.95	3.3905
40	C	23-Jan-02	8	21.433	0.6328	3.02	3.5374
41	C	10-Jan-02	8	21.517	0.5051	2.57	2.8234
41	C	28-Jan-02	8	21.417	0.5175	2.54	2.8929
41	C	6-Jan-02	8	21.575	0.4797	2.45	2.6816
42	C	10-Jan-02	8	21.525	0.5044	2.59	2.8197
42	C	28-Jan-02	8	21.417	0.5102	2.49	2.8521
42	C	23-Jan-02	8	21.442	0.5346	2.6	2.9884
43	C	10-Jan-02	9	21.542	0.0798	0.47	0.4458
43	C	28-Jan-02	9	21.425	0.3288	1.71	1.8381
43	C	6-Jan-02	9	21.592	0.076	0.44	0.4248
44	C	10-Jan-02	9	21.517	0.6568	3.24	3.6713
44	C	28-Jan-02	9	21.417	0.6399	3.06	3.5773
44	C	23-Jan-02	9	21.433	0.6574	3.15	3.6751
45	C	10-Jan-02	9	21.517	0.6179	3.02	3.454
45	C	28-Jan-02	9	21.425	0.6412	3.07	3.5842

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (µS*min)	Height (µS)	Amount (ppm)
45	C	23-Jan-02	9	21.433	0.6539	3.14	3.6552
46	C	28-Jan-02	10	21.417	0.5941	2.89	3.3211
46	C	10-Jan-02	10	21.517	0.5763	2.85	3.2216
46	C	23-Jan-02	10	21.433	0.6015	2.92	3.3626
47	C	28-Jan-02	10	21.417	0.4745	2.35	2.6527
47	C	10-Jan-02	10	21.517	0.4658	2.36	2.6041
47	C	23-Jan-02	10	21.442	0.4991	2.43	2.7901
48	C	28-Jan-02	10	21.417	0.5305	2.61	2.9654
48	C	10-Jan-02	10	21.517	0.5521	2.71	3.0865
48	C	6-Jan-02	10	21.567	0.5322	2.68	2.9753
49	C	28-Jan-02	11	21.433	0.043	0.32	0.2406
49	C	10-Jan-02	11	N/D	N/D	N/D	N/D
49	C	6-Jan-02	11	N/D	N/D	N/D	N/D
50	C	28-Jan-02	11	21.408	0.6275	3.05	3.508
50	C	10-Jan-02	11	21.508	0.6172	3.05	3.4505
50	C	6-Jan-02	11	21.567	0.5777	2.89	3.2296
51	C	28-Jan-02	11	21.417	0.6427	3.11	3.593
51	C	10-Jan-02	11	21.5	0.6497	3.12	3.6316
51	C	6-Jan-02	11	21.567	0.5912	2.9	3.3049
52	C	28-Jan-02	12	21.408	0.6077	2.96	3.3972
52	C	10-Jan-02	12	21.508	0.6157	3.05	3.4419
52	C	23-Jan-02	12	21.433	0.6497	3.11	3.6318
53	C	28-Jan-02	12	21.417	0.6501	3.13	3.6342
53	C	10-Jan-02	12	21.5	0.65	3.12	3.6333
53	C	23-Jan-02	12	21.425	0.6635	3.2	3.709
54	C	28-Jan-02	12	21.417	0.6	2.91	3.3541
54	C	10-Jan-02	12	21.508	0.5865	2.88	3.2784
54	C	23-Jan-02	12	21.433	0.5985	2.91	3.3459
55	C	28-Jan-02	13	21.417	0.473	2.32	2.6442
55	C	10-Jan-02	13	21.517	0.4426	2.23	2.4744
55	C	23-Jan-02	13	21.442	0.4837	2.38	2.7041
56	C	28-Jan-02	13	21.417	0.5654	2.75	3.1607
56	C	10-Jan-02	13	21.508	0.5814	2.83	3.2501
56	C	23-Jan-02	13	21.433	0.6093	2.97	3.4062
57	C	28-Jan-02	13	21.417	0.5992	2.91	3.3496
57	C	10-Jan-02	13	21.508	0.5766	2.86	3.2233
57	C	23-Jan-02	13	21.433	0.6149	3	3.4371
58	C	28-Jan-02	12	21.417	0.5479	2.67	3.0629
58	C	10-Jan-02	12	21.508	0.5652	2.76	3.1598
58	C	23-Jan-02	12	21.433	0.5618	2.73	3.1407
59	C	28-Jan-02	12	21.417	0.5793	2.81	3.2383
59	C	10-Jan-02	12	21.5	0.5808	2.83	3.2466
59	C	23-Jan-02	12	21.433	0.6062	2.93	3.3887
60	C	28-Jan-02	12	21.417	0.5898	2.88	3.2968

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
60	C	10-Jan-02	12	21.5	0.6004	2.91	3.3564
60	C	6-Jan-02	12	21.558	0.6282	3.14	3.5117
61	C	28-Jan-02	13	21.417	0.5087	2.51	2.8438
61	C	10-Jan-02	13	21.508	0.5666	2.71	3.1675
61	C	23-Jan-02	13	21.433	0.5454	2.68	3.0489
62	C	28-Jan-02	13	21.417	0.5836	2.84	3.2626
62	C	10-Jan-02	13	21.508	0.5635	2.75	3.1498
62	C	23-Jan-02	13	21.433	0.5843	2.86	3.2666
63	C	28-Jan-02	13	21.408	0.4887	2.4	2.7319
63	C	10-Jan-02	13	21.508	0.4992	2.5	2.7905
63	C	23-Jan-02	13	21.433	0.5241	2.59	2.93
64	C	28-Jan-02	14	21.408	0.5518	2.67	3.0848
64	C	10-Jan-02	14	21.508	0.5794	2.82	3.239
64	C	23-Jan-02	14	21.442	0.5972	2.86	3.3385
65	C	28-Jan-02	14	21.417	0.5799	2.8	3.2418
65	C	10-Jan-02	14	21.508	0.5677	2.76	3.1734
65	C	23-Jan-02	14	21.433	0.601	2.92	3.3595
66	C	28-Jan-02	14	21.417	0.5314	2.59	2.9705
66	C	10-Jan-02	14	21.508	0.5491	2.68	3.0696
66	C	23-Jan-02	14	21.45	0.5659	2.78	3.1636

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix AJ: Nitrate, Field Blanks, Influent and Effluent

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
Blank	BLANK	10-Jan-02	B	21.492	0.0195	0.06	0.1092
Blank	BLANK	26-Jan-02	B	21.45	0.0042	0.03	0.0236
Blank	BLANK	28-Jan-02	B	21.45	0.0035	0.02	0.0196
Influent	INFLUENT	5-Jan-02	I	21.575	0.6046	2.99	3.38
Influent	INFLUENT	10-Jan-02	I	21.517	0.6348	3.09	3.5488
Influent	INFLUENT	6-Jan-02	I	21.567	0.6087	2.99	3.4028
Effluent	EFFLUENT	5-Jan-02	E	21.617	0.0687	0.36	0.3839
Effluent	EFFLUENT	10-Jan-02	E	N/D	N/D	N/D	N/D
Effluent	EFFLUENT	6-Jan-02	E	21.575	0.4063	2.17	2.271

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix AK: Nitrite, Strata A

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	A	16-Jan-02	1	16.783	0.0003	0	0.0018
1	A	17-Jan-02	1	16.758	0.0003	0	0.002
1	A	23-Jan-02	1	16.775	0.0008	0.01	0.0045
2	A	16-Jan-02	1	16.783	0.0004	0	0.0024
2	A	17-Jan-02	1	16.767	0.0001	0	0.0008
2	A	23-Jan-02	1	16.767	0.0005	0	0.003
3	A	18-Jan-02	1	16.758	0.0003	0	0.002
3	A	16-Jan-02	1	N/D	N/D	N/D	N/D
3	A	17-Jan-02	1	16.767	0	0	0.0002
4	A	18-Jan-02	2	16.267	0.0008	0	0.0048
4	A	16-Jan-02	2	16.767	0.0001	0	0.0005
4	A	17-Jan-02	2	16.767	0	0	0.0003
5	A	18-Jan-02	2	N/D	N/D	N/D	N/D
5	A	16-Jan-02	2	N/D	N/D	N/D	N/D
5	A	17-Jan-02	2	16.808	0	0	0.0002
6	A	18-Jan-02	2	N/D	N/D	N/D	N/D
6	A	16-Jan-02	2	16.783	0.0001	0	0.0008
6	A	17-Jan-02	2	16.783	0.0001	0	0.0007
7	A	17-Jan-02	1	16.758	0.0011	0.01	0.0063
7	A	23-Jan-02	1	16.767	0.0001	0	0.0006
8	A	18-Jan-02	1	16.308	0.0006	0	0.0036
8	A	16-Jan-02	1	N/D	N/D	N/D	N/D
8	A	17-Jan-02	1	N/D	N/D	N/D	N/D
9	A	18-Jan-02	1	16.775	0.0001	0	0.0006
9	A	16-Jan-02	1	16.775	0.0001	0	0.0006
9	A	17-Jan-02	1	16.792	0.0001	0	0.0005
10	A	18-Jan-02	2	16.767	0.001	0.01	0.0058
10	A	10-Jan-02	2	16.692	0.0022	0.01	0.0134
10	A	16-Jan-02	2	16.767	0.0019	0.01	0.0115
10	A	14-Jan-02	2	16.8	0.0019	0.01	0.0114
11	A	18-Jan-02	2	N/D	N/D	N/D	N/D
11	A	10-Jan-02	2	16.8	0.0002	0	0.0011
11	A	16-Jan-02	2	N/D	N/D	N/D	N/D
11	A	14-Jan-02	2	N/D	N/D	N/D	N/D
12	A	18-Jan-02	2	16.775	0.0001	0	0.0008
12	A	10-Jan-02	2	16.792	0.0001	0	0.0006
12	A	16-Jan-02	2	N/D	N/D	N/D	N/D
13	A	18-Jan-02	3	16.75	0.0001	0	0.0007
13	A	16-Jan-02	3	16.758	0	0	0.0002
13	A	17-Jan-02	3	16.75	0.0002	0	0.0011
14	A	18-Jan-02	3	16.767	0.0001	0	0.0006
14	A	23-Jan-02	3	N/D	N/D	N/D	N/D
14	A	14-Jan-02	3	16.783	0.0005	0	0.003

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
15	A	18-Jan-02	3	16.767	0.0002	0	0.001
15	A	17-Jan-02	3	16.775	0	0	0.0003
15	A	23-Jan-02	3	16.767	0.0001	0	0.0003
16*	A	18-Jan-02	4	16.75	0.0032	0.02	0.019
16	A	10-Jan-02	4	16.808	0.0016	0.01	0.0093
16*	A	23-Jan-02	4	16.75	0.0032	0.02	0.0189
17	A	17-Jan-02	4	16.783	0.0001	0	0.0004
17	A	18-Jan-02	4	16.783	0.0003	0	0.0019
17	A	23-Jan-02	4	16.767	0.0001	0	0.0007
18	A	18-Jan-02	4	16.792	0.0004	0	0.0021
18	A	23-Jan-02	4	16.758	0.0001	0	0.0004
18	A	14-Jan-02	4	16.8	0	0	0.0001
19	A	17-Jan-02	3	16.767	0.0001	0	0.0006
19	A	18-Jan-02	3	16.8	0.0001	0	0.0009
19	A	24-Jan-02	3	16.758	0	0	0.0003
20*	A	10-Jan-02	3	16.817	0.0036	0.02	0.0214
20	A	18-Jan-02	3	16.75	0.0005	0	0.0032
20	A	23-Jan-02	3	16.75	0.0005	0	0.003
21	A	10-Jan-02	3	16.833	0.0005	0	0.0031
21	A	18-Jan-02	3	16.767	0.0005	0	0.0029
21	A	23-Jan-02	3	16.758	0.0003	0	0.0019
22	A	10-Jan-02	4	16.833	0.0006	0	0.0037
22	A	18-Jan-02	4	16.767	0.0035	0.02	0.0211
22	A	23-Jan-02	4	16.75	0.0016	0.01	0.0097
23	A	10-Jan-02	4	16.85	0.0001	0	0.0007
23	A	18-Jan-02	4	16.8	0.0001	0	0.0004
23	A	14-Jan-02	4	N/D	N/D	N/D	N/D
24	A	10-Jan-02	4	16.875	0.0002	0	0.0013
24	A	18-Jan-02	4	16.767	0.0004	0	0.0021
24	A	14-Jan-02	4	16.783	0.001	0.01	0.0057
25*	A	10-Jan-02	5	16.817	0.0038	0.01	0.0229
25	A	18-Jan-02	5	16.758	0.0006	0	0.0036
25	A	23-Jan-02	5	16.758	0.0004	0	0.0026
26	A	17-Jan-02	5	16.758	0.0001	0	0.0005
26	A	18-Jan-02	5	16.775	0.0003	0	0.0017
26	A	23-Jan-02	5	16.725	0.0001	0	0.0007
27	A	18-Jan-02	5	16.967	0.0002	0	0.0011
27	A	23-Jan-02	5	16.725	0.0003	0	0.0016
27	A	14-Jan-02	5	N/D	N/D	N/D	N/D
28	A	10-Jan-02	6	16.658	0.0002	0	0.0011
28	A	18-Jan-02	6	16.783	0.0003	0	0.0017
28	A	23-Jan-02	6	16.758	0.0002	0	0.0014
29	A	10-Jan-02	6	16.808	0.0014	0.01	0.0083



Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
29	A	18-Jan-02	6	16.775	0.0015	0.01	0.0087
29	A	23-Jan-02	6	16.742	0.001	0.01	0.0058
30*	A	10-Jan-02	6	16.808	0.003	0.02	0.0182
30	A	18-Jan-02	6	16.767	0.0028	0.02	0.0166
30*	A	24-Jan-02	6	16.742	0.0033	0.02	0.0196
31	A	10-Jan-02	5	16.892	0.0001	0	0.0004
31	A	18-Jan-02	5	16.775	0.0005	0	0.003
31	A	14-Jan-02	5	N/D	N/D	N/D	N/D
32	A	17-Jan-02	5	16.792	0.0002	0	0.0014
32	A	18-Jan-02	5	16.758	0.0002	0	0.0011
32	A	23-Jan-02	5	16.75	0.0001	0	0.0006
33	A	18-Jan-02	5	16.775	0.0005	0	0.0029
33	A	23-Jan-02	5	16.742	0.0007	0	0.0041
33	A	14-Jan-02	5	16.775	0.0012	0	0.0071
34	A	22-Jan-02	8	17	0.0012	0	0.0073
34	A	10-Jan-02	8	16.833	0.0001	0	0.0003
34	A	24-Jan-02	8	16.833	0	0	0.0001
35	A	22-Jan-02	8	16.808	0.0001	0	0.0005
35	A	10-Jan-02	8	16.825	0.0003	0	0.0018
35	A	24-Jan-02	8	16.742	0.0003	0	0.0017
36	A	17-Jan-02	8	16.783	0.0013	0.01	0.0077
36	A	22-Jan-02	8	16.775	0.0026	0.01	0.0152
36*	A	24-Jan-02	8	16.742	0.0052	0.04	0.031
37	A	22-Jan-02	7	16.783	0.0002	0	0.0013
37	A	10-Jan-02	7	16.85	0.0003	0	0.0019
37	A	24-Jan-02	7	16.75	0.0001	0	0.0006
38	A	22-Jan-02	7	16.825	0	0	0
38	A	10-Jan-02	7	16.808	0.0009	0.01	0.0054
38	A	24-Jan-02	7	16.758	0.0001	0	0.0006
39	A	17-Jan-02	7	N/D	N/D	N/D	N/D
39	A	22-Jan-02	7	16.975	0	0	0.0001
39	A	24-Jan-02	7	16.783	0.0001	0	0.0007
40	A	17-Jan-02	8	16.933	0.0003	0	0.0017
40	A	22-Jan-02	8	16.808	0	0	0.0003
40	A	24-Jan-02	8	N/D	N/D	N/D	N/D
41	A	22-Jan-02	8	N/D	N/D	N/D	N/D
41	A	10-Jan-02	8	17.05	0.0019	0	0.0114
41	A	24-Jan-02	8	16.892	0.0001	0	0.0005
42	A	17-Jan-02	8	16.8	0.0001	0	0.0005
42	A	22-Jan-02	8	N/D	N/D	N/D	N/D
42	A	24-Jan-02	8	16.758	0.0001	0	0.0005
43	A	22-Jan-02	9	16.792	0	0	0.0001
43	A	10-Jan-02	9	16.8	0.0001	0	0.0004
43	A	14-Jan-02	9	16.792	0	0	0.0003

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
44	A	22-Jan-02	9	17.05	0.0019	0	0.0116
44	A	10-Jan-02	9	16.858	0	0	0.0001
44	A	14-Jan-02	9	16.8	0.0002	0	0.0011
45	A	22-Jan-02	9	16.817	0.0001	0	0.0005
45	A	10-Jan-02	9	16.817	0.0002	0	0.0011
45	A	24-Jan-02	9	16.733	0.0002	0	0.0011
46	A	17-Jan-02	10	16.992	0.0006	0	0.0036
46	A	22-Jan-02	10	16.825	0	0	0.0002
46	A	24-Jan-02	10	16.85	0.0001	0	0.0005
47	A	17-Jan-02	10	16.917	0.0006	0	0.0037
47	A	22-Jan-02	10	N/D	N/D	N/D	N/D
47	A	24-Jan-02	10	16.767	0.0003	0	0.0019
48	A	22-Jan-02	10	16.792	0	0	0.0001
48	A	10-Jan-02	10	16.825	0.0003	0	0.0017
48	A	14-Jan-02	10	16.783	0.0003	0	0.0017
49	A	22-Jan-02	11	16.783	0.0001	0	0.0006
49	A	10-Jan-02	11	16.808	0.0001	0	0.0006
49	A	24-Jan-02	11	N/D	N/D	N/D	N/D
50	A	22-Jan-02	11	N/D	N/D	N/D	N/D
50	A	10-Jan-02	11	16.783	0.0004	0	0.0022
50	A	24-Jan-02	11	N/D	N/D	N/D	N/D
51	A	22-Jan-02	11	N/D	N/D	N/D	N/D
51	A	10-Jan-02	11	N/D	N/D	N/D	N/D
51	A	24-Jan-02	11	N/D	N/D	N/D	N/D
52	A	17-Jan-02	12	16.792	0.0001	0	0.0004
52	A	22-Jan-02	12	16.792	0.0001	0	0.0004
52	A	24-Jan-02	12	N/D	N/D	N/D	N/D
53	A	17-Jan-02	12	16.842	0.0001	0	0.0005
53	A	22-Jan-02	12	16.808	0.0001	0	0.0004
53	A	24-Jan-02	12	N/D	N/D	N/D	N/D
54	A	22-Jan-02	12	N/D	N/D	N/D	N/D
54	A	10-Jan-02	12	16.758	0	0	0.0002
54	A	24-Jan-02	12	N/D	N/D	N/D	N/D
55	A	22-Jan-02	13	16.717	0	0	0.0001
55	A	10-Jan-02	13	16.775	0.0001	0	0.0008
55	A	24-Jan-02	13	N/D	N/D	N/D	N/D
56	A	17-Jan-02	13	16.75	0.0005	0	0.0029
56	A	22-Jan-02	13	N/D	N/D	N/D	N/D
56	A	24-Jan-02	13	N/D	N/D	N/D	N/D
57	A	22-Jan-02	13	N/D	N/D	N/D	N/D
57	A	10-Jan-02	13	16.808	0.0001	0	0.0005
57	A	24-Jan-02	13	N/D	N/D	N/D	N/D
58	A	22-Jan-02	12	16.783	0	0	0.0002
58	A	10-Jan-02	12	16.825	0	0	0.0001

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
58	A	24-Jan-02	12	N/D	N/D	N/D	N/D
59	A	22-Jan-02	12	N/D	N/D	N/D	N/D
59	A	10-Jan-02	12	16.808	0	0	0
59	A	24-Jan-02	12	N/D	N/D	N/D	N/D
60	A	22-Jan-02	12	N/D	N/D	N/D	N/D
60	A	10-Jan-02	12	16.817	0.0003	0	0.0019
60	A	14-Jan-02	12	16.783	0.0003	0	0.0019
61	A	22-Jan-02	13	N/D	N/D	N/D	N/D
61	A	10-Jan-02	13	16.858	0.0001	0	0.0008
61	A	14-Jan-02	13	16.767	0.0001	0	0.0005
62	A	22-Jan-02	13	16.925	0.0005	0	0.0028
62	A	10-Jan-02	13	16.833	0.0003	0	0.0018
62	A	24-Jan-02	13	N/D	N/D	N/D	N/D
63	A	22-Jan-02	13	16.767	0.0014	0.01	0.0082
63	A	10-Jan-02	13	16.792	0.0007	0	0.0044
63	A	14-Jan-02	13	16.783	0.0005	0	0.0029
64	A	22-Jan-02	14	16.767	0.0001	0	0.0003
64	A	10-Jan-02	14	16.8	0.0003	0	0.0016
64	A	24-Jan-02	14	N/D	N/D	N/D	N/D
65	A	17-Jan-02	14	16.792	0.0001	0	0.0008
65	A	22-Jan-02	14	16.792	0	0	0.0003
65	A	24-Jan-02	14	N/D	N/D	N/D	N/D
66	A	17-Jan-02	14	N/D	N/D	N/D	N/D
66	A	23-Jan-02	14	N/D	N/D	N/D	N/D
66	A	24-Jan-02	14	N/D	N/D	N/D	N/D

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix AL: Nitrite, Strata B

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (µS*min)	Height (µS)	Amount (ppm)
1*	B	25-Jan-02	1	16.767	0.0122	0.08	0.0732
1	B	17-Jan-02	1	16.758	0.0011	0.01	0.0063
1	B	15-Jan-02	1	16.792	0.0016	0.01	0.0097
2	B	25-Jan-02	1	16.767	0.0006	0	0.0037
2	B	13-Jan-02	1	16.825	0.0002	0	0.0013
2	B	15-Jan-02	1	17.008	0.0016	0	0.0094
3	B	25-Jan-02	1	16.75	0.0001	0	0.0004
3	B	13-Jan-02	1	16.833	0.0011	0	0.0063
3	B	15-Jan-02	1	16.65	0.0025	0.02	0.0151
4	B	25-Jan-02	2	16.75	0.0002	0	0.0009
4	B	13-Jan-02	2	16.792	0.0002	0	0.001
4	B	15-Jan-02	2	16.825	0	0	0.0001
5	B	25-Jan-02	2	16.775	0.0001	0	0.0006
5	B	17-Jan-02	2	16.792	0.0001	0	0.0006
5	B	15-Jan-02	2	16.817	0.0011	0	0.0066
6	B	25-Jan-02	2	16.767	0.0002	0	0.001
6	B	13-Jan-02	2	16.808	0.0002	0	0.0011
6	B	15-Jan-02	2	16.5	0.0001	0	0.0006
7	B	25-Jan-02	1	16.767	0.0001	0	0.0007
7	B	17-Jan-02	1	16.775	0.0001	0	0.0004
7	B	15-Jan-02	1	16.792	0.0007	0	0.0042
8	B	25-Jan-02	1	16.767	0.0001	0	0.0005
8	B	13-Jan-02	1	16.817	0.0003	0	0.0016
8	B	15-Jan-02	1	16.825	0	0	0.0002
9	B	25-Jan-02	1	16.742	0.0001	0	0.0008
9	B	13-Jan-02	1	16.8	0.0012	0	0.0072
9	B	15-Jan-02	1	16.817	0.0001	0	0.0005
10	B	25-Jan-02	2	16.742	0.001	0.01	0.0062
10	B	13-Jan-02	2	16.792	0.0013	0.01	0.0079
10	B	15-Jan-02	2	16.783	0.001	0.01	0.0062
11	B	25-Jan-02	2	16.742	0.0021	0.01	0.0127
11	B	13-Jan-02	2	16.792	0.0017	0.01	0.0104
11	B	15-Jan-02	2	16.792	0.0019	0.01	0.0112
12	B	25-Jan-02	2	16.767	0.0001	0	0.0006
12	B	13-Jan-02	2	16.817	0.0001	0	0.0005
12	B	15-Jan-02	2	16.25	0	0	0.0001
13	B	17-Jan-02	3	N/D	N/D	N/D	N/D
14	B	25-Jan-02	3	16.767	0.0001	0	0.0006
14	B	13-Jan-02	3	16.833	0.0008	0	0.0051
14	B	15-Jan-02	3	N/D	N/D	N/D	N/D
15	B	25-Jan-02	3	16.758	0.0001	0	0.0003
15	B	13-Jan-02	3	16.842	0.0001	0	0.0004
15	B	15-Jan-02	3	16.808	0.0004	0	0.0026

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
16	B	25-Jan-02	4	16.758	0.0002	0	0.001
16	B	13-Jan-02	4	N/D	N/D	N/D	N/D
16	B	15-Jan-02	4	16.833	0.0001	0	0.0004
17	B	25-Jan-02	4	16.75	0.0001	0	0.0004
17	B	17-Jan-02	4	16.775	0.0001	0	0.0006
17	B	15-Jan-02	4	N/D	N/D	N/D	N/D
18	B	25-Jan-02	4	N/D	N/D	N/D	N/D
18	B	17-Jan-02	4	N/D	N/D	N/D	N/D
18	B	15-Jan-02	4	16.817	0.0001	0	0.0003
19	B	25-Jan-02	3	N/D	N/D	N/D	N/D
19	B	17-Jan-02	3	16.783	0	0	0.0002
19	B	16-Jan-02	3	16.792	0.0003	0	0.0016
20*	B	25-Jan-02	3	16.742	0.0087	0.06	0.0518
20*	B	13-Jan-02	3	16.783	0.0091	0.06	0.0544
20	B	15-Jan-02	3	16.792	0.0055	0.04	0.0326
21	B	25-Jan-02	3	16.75	0.0001	0	0.0007
21	B	13-Jan-02	3	16.8	0.0006	0	0.0033
21	B	15-Jan-02	3	16.808	0.0002	0	0.0011
22	B	25-Jan-02	4	16.742	0.0002	0	0.0011
22	B	13-Jan-02	4	16.792	0.0005	0	0.0031
22	B	15-Jan-02	4	16.783	0.0003	0	0.0016
23	B	25-Jan-02	4	16.75	0.0001	0	0.0006
23	B	13-Jan-02	4	16.85	0.0001	0	0.0007
23	B	15-Jan-02	4	N/D	N/D	N/D	N/D
24	B	25-Jan-02	4	16.75	0.0001	0	0.0006
24	B	13-Jan-02	4	N/D	N/D	N/D	N/D
24	B	15-Jan-02	4	N/D	N/D	N/D	N/D
25	B	25-Jan-02	5	16.767	0.0003	0	0.002
25	B	13-Jan-02	5	16.8	0.0006	0	0.0038
25	B	15-Jan-02	5	16.792	0.0004	0	0.0022
26	B	25-Jan-02	5	16.758	0.0001	0	0.0007
26	B	13-Jan-02	5	16.867	0.0001	0	0.0007
26	B	15-Jan-02	5	16.783	0.0008	0.01	0.0047
27	B	25-Jan-02	5	16.775	0.0001	0	0.0007
27	B	13-Jan-02	5	16.808	0.0001	0	0.0008
27	B	15-Jan-02	5	16.775	0.0002	0	0.0011
28	B	25-Jan-02	6	16.742	0.0006	0	0.0039
28	B	13-Jan-02	6	16.792	0.0001	0	0.0005
28	B	15-Jan-02	6	16.775	0.0005	0	0.0029
29	B	25-Jan-02	6	16.75	0.0001	0	0.0007
29	B	13-Jan-02	6	16.792	0.0002	0	0.0012
29	B	15-Jan-02	6	16.8	0.0005	0	0.0028
30	B	25-Jan-02	6	16.758	0.0001	0	0.0004
30	B	13-Jan-02	6	16.817	0.0001	0	0.0008

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
30	B	15-Jan-02	6	16.808	0	0	0.0002
31	B	25-Jan-02	5	16.742	0.0012	0.01	0.0073
31*	B	13-Jan-02	5	16.783	0.0087	0.06	0.0522
31	B	15-Jan-02	5	16.783	0.0046	0.03	0.0275
32	B	13-Jan-02	5	16.792	0.0007	0	0.0043
32	B	15-Jan-02	5	16.8	0.0003	0	0.0017
32	B	16-Jan-02	5	16.8	0.0032	0.01	0.0191
33	B	25-Jan-02	5	16.758	0.0003	0	0.0016
33	B	13-Jan-02	5	16.792	0.0004	0	0.0021
33	B	15-Jan-02	5	16.792	0.0005	0	0.0028
34	B	16-Jan-02	8	16.342	0	0	0.0001
34	B	26-Jan-02	8	16.767	0.0003	0	0.0016
34	B	13-Jan-02	8	16.867	0.0019	0.01	0.0116
35	B	16-Jan-02	8	16.783	0.0002	0	0.0013
35	B	26-Jan-02	8	16.767	0.0001	0	0.0006
35	B	13-Jan-02	8	16.825	0.0001	0	0.0005
36	B	16-Jan-02	8	16.792	0.001	0	0.0062
36	B	26-Jan-02	8	16.775	0.0001	0	0.0008
36	B	13-Jan-02	8	16.825	0.0001	0	0.0007
37	B	26-Jan-02	7	16.75	0.0021	0.01	0.0123
37	B	13-Jan-02	7	16.8	0.0005	0	0.003
37	B	23-Jan-02	7	16.775	0.0005	0	0.0033
38	B	16-Jan-02	7	16.792	0.0003	0	0.002
38	B	26-Jan-02	7	16.75	0.0015	0.01	0.0089
38	B	13-Jan-02	7	16.817	0.0004	0	0.0023
39	B	16-Jan-02	7	16.783	0.002	0.01	0.0119
39	B	26-Jan-02	7	16.75	0.0024	0.02	0.0145
39	B	13-Jan-02	7	16.792	0.0002	0	0.0013
40	B	16-Jan-02	8	N/D	N/D	N/D	N/D
40	B	26-Jan-02	8	16.8	0.0001	0	0.0005
40	B	13-Jan-02	8	17.05	0.0006	0	0.0035
41	B	16-Jan-02	8	N/D	N/D	N/D	N/D
41	B	26-Jan-02	8	16.75	0.0001	0	0.0009
41	B	13-Jan-02	8	N/D	N/D	N/D	N/D
42	B	16-Jan-02	8	16.292	0.0008	0	0.0045
42	B	26-Jan-02	8	16.767	0.0001	0	0.0004
42	B	13-Jan-02	8	N/D	N/D	N/D	N/D
43	B	16-Jan-02	9	16.783	0.0003	0	0.002
43	B	26-Jan-02	9	16.758	0.0003	0	0.0016
43	B	13-Jan-02	9	16.8	0.0005	0	0.0033
44	B	16-Jan-02	9	N/D	N/D	N/D	N/D
44	B	26-Jan-02	9	16.75	0.0001	0	0.0008
44	B	13-Jan-02	9	16.817	0.0001	0	0.0007
45	B	16-Jan-02	9	16.783	0.0009	0.01	0.0055

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
45*	B	26-Jan-02	9	16.742	0.0162	0.11	0.0966
45	B	13-Jan-02	9	16.8	0.001	0.01	0.0057
46	B	16-Jan-02	10	16.817	0.0001	0	0.0008
46	B	26-Jan-02	10	16.775	0.0002	0	0.001
46	B	13-Jan-02	10	N/D	N/D	N/D	N/D
47	B	16-Jan-02	10	16.292	0.0005	0	0.0027
47	B	26-Jan-02	10	16.8	0.0001	0	0.0005
47	B	13-Jan-02	10	16.308	0.0005	0	0.0029
48	B	15-Jan-02	10	16.783	0.0003	0	0.0018
48	B	16-Jan-02	10	16.792	0.0002	0	0.001
48	B	13-Jan-02	10	16.792	0.0016	0.01	0.0098
49	B	16-Jan-02	11	17.158	0.0001	0	0.0004
49	B	26-Jan-02	11	16.758	0.0003	0	0.0016
49	B	13-Jan-02	11	16.792	0.002	0.02	0.0119
50	B	26-Jan-02	11	16.75	0.0007	0	0.004
50	B	13-Jan-02	11	16.758	0.0005	0	0.003
50	B	23-Jan-02	11	16.792	0.0004	0	0.0023
51	B	16-Jan-02	11	16.808	0.0005	0	0.0032
51	B	26-Jan-02	11	16.733	0.0001	0	0.0005
51	B	13-Jan-02	11	16.833	0.0001	0	0.0005
52	B	16-Jan-02	12	16.767	0.0001	0	0.0008
52	B	26-Jan-02	12	16.742	0.0046	0.03	0.0275
52	B	13-Jan-02	12	N/D	N/D	N/D	N/D
53	B	16-Jan-02	12	16.783	0.0002	0	0.0011
53	B	26-Jan-02	12	16.75	0.0001	0	0.0007
53	B	13-Jan-02	12	16.8	0.0008	0	0.0046
54	B	16-Jan-02	12	16.825	0.0002	0	0.0011
54	B	26-Jan-02	12	16.725	0.0001	0	0.0007
54	B	13-Jan-02	12	N/D	N/D	N/D	N/D
55	B	16-Jan-02	13	N/D	N/D	N/D	N/D
55	B	26-Jan-02	13	16.733	0.0045	0.03	0.027
55	B	13-Jan-02	13	16.817	0.0003	0	0.0017
56	B	15-Jan-02	13	16.783	0.0002	0	0.0014
56	B	16-Jan-02	13	N/D	N/D	N/D	N/D
57	B	16-Jan-02	13	16.3	0.0002	0	0.0011
57	B	26-Jan-02	13	16.767	0.0001	0	0.0005
57	B	13-Jan-02	13	16.242	0.001	0	0.0057
58	B	16-Jan-02	12	16.792	0.0006	0	0.0037
58	B	26-Jan-02	12	16.775	0.0001	0	0.0004
58	B	13-Jan-02	12	16.817	0.0007	0	0.0045
59	B	16-Jan-02	12	16.792	0.0001	0	0.0006
59	B	26-Jan-02	12	16.75	0.0001	0	0.0008
59	B	13-Jan-02	12	16.8	0.0003	0	0.002
60	B	16-Jan-02	12	16.817	0	0	0.0001

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
60	B	26-Jan-02	12	16.75	0.0002	0	0.0009
60	B	13-Jan-02	12	16.792	0	0	0.0003
61	B	16-Jan-02	13	16.775	0.0048	0.03	0.0286
61	B	26-Jan-02	13	16.742	0.0001	0	0.0009
61	B	13-Jan-02	13	16.8	0.0001	0	0.0006
62	B	16-Jan-02	13	16.792	0.0001	0	0.0007
62	B	26-Jan-02	13	16.692	0.0001	0	0.0008
62	B	13-Jan-02	13	16.9	0.0004	0	0.0025
63	B	16-Jan-02	13	N/D	N/D	N/D	N/D
63	B	26-Jan-02	13	16.742	0.0002	0	0.0012
63	B	13-Jan-02	13	16.842	0.0002	0	0.0013
64	B	16-Jan-02	14	N/D	N/D	N/D	N/D
64	B	26-Jan-02	14	16.758	0.0001	0	0.0006
64	B	13-Jan-02	14	16.817	0.0001	0	0.0003
65	B	16-Jan-02	14	16.8	0.0001	0	0.0004
65	B	26-Jan-02	14	16.733	0	0	0.0002
65	B	13-Jan-02	14	16.808	0.0001	0	0.0005
66	B	16-Jan-02	14	16.775	0.0001	0	0.0007
66	B	26-Jan-02	14	16.758	0.0001	0	0.0005
66	B	13-Jan-02	14	16.792	0.0029	0.01	0.0172

\*—JMP 4.0 Outlier

N/D—Not Detected



### Appendix AM: Nitrite, Strata C

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	C	16-Jan-02	1	16.8	0.001	0.01	0.0061
1	C	17-Jan-02	1	16.792	0.0003	0	0.0017
1	C	26-Jan-02	1	16.767	0.0004	0	0.0023
2*	C	16-Jan-02	1	16.792	0.0053	0.04	0.0315
2	C	17-Jan-02	1	16.775	0.001	0.01	0.0061
2	C	26-Jan-02	1	16.75	0.0005	0	0.0032
3	C	16-Jan-02	1	16.783	0.0034	0.02	0.0204
3	C	17-Jan-02	1	16.767	0.0018	0.01	0.011
3	C	26-Jan-02	1	16.75	0.0026	0.02	0.0156
4*	C	16-Jan-02	2	16.775	0.0047	0.03	0.0283
4	C	17-Jan-02	2	16.767	0.0016	0.01	0.0094
4*	C	26-Jan-02	2	16.758	0.0062	0.04	0.037
5	C	16-Jan-02	2	16.783	0.001	0.01	0.0057
5	C	17-Jan-02	2	16.758	0.0003	0	0.0015
5	C	26-Jan-02	2	16.758	0.0005	0	0.0028
7	C	16-Jan-02	1	16.775	0.0023	0.02	0.0138
7	C	26-Jan-02	1	16.75	0.0014	0.01	0.0084
7	C	22-Jan-02	1	16.767	0.0009	0.01	0.0052
8	C	26-Jan-02	1	16.75	0.0002	0	0.0011
8	C	23-Jan-02	1	16.767	0.0002	0	0.0015
8	C	22-Jan-02	1	16.758	0.0002	0	0.0009
9*	C	16-Jan-02	1	16.775	0.0064	0.04	0.038
9	C	26-Jan-02	1	16.742	0.0019	0.01	0.0114
9	C	22-Jan-02	1	16.767	0.0009	0.01	0.0054
10	C	16-Jan-02	2	16.775	0.0038	0.03	0.0229
10	C	26-Jan-02	2	16.75	0.0018	0.01	0.0107
10*	C	6-Jan-02	2	16.633	0.0061	0.04	0.0366
11*	C	16-Jan-02	2	16.775	0.0069	0.05	0.041
11	C	26-Jan-02	2	16.75	0.0009	0.01	0.0053
11	C	6-Jan-02	2	16.758	0.0026	0.01	0.0155
12*	C	16-Jan-02	2	16.775	0.0059	0.04	0.0352
12	C	26-Jan-02	2	16.742	0.0012	0.01	0.0069
12	C	23-Jan-02	2	16.75	0.0009	0.01	0.0052
13*	C	16-Jan-02	3	16.783	0.0078	0.05	0.0464
13	C	10-Jan-02	3	16.658	0.0016	0.01	0.0095
13	C	26-Jan-02	3	16.742	0.0017	0.01	0.0101
14	C	10-Jan-02	3	16.75	0.0003	0	0.002
14	C	26-Jan-02	3	16.733	0.0007	0	0.0042
14	C	23-Jan-02	3	16.742	0.0003	0	0.0018
15	C	10-Jan-02	3	16.8	0.0007	0	0.0043
15	C	26-Jan-02	3	16.742	0.0011	0.01	0.0067
15	C	23-Jan-02	3	16.758	0.0008	0.01	0.0046

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
16	C	10-Jan-02	4	16.8	0.0016	0.01	0.0096
16	C	26-Jan-02	4	16.742	0.001	0.01	0.0062
16	C	6-Jan-02	4	16.8	0.0001	0	0.0007
17	C	10-Jan-02	4	16.808	0.001	0.01	0.0061
17	C	26-Jan-02	4	16.75	0.0009	0.01	0.0053
17	C	23-Jan-02	4	16.758	0.001	0.01	0.0059
18	C	10-Jan-02	4	16.808	0.0012	0.01	0.0069
18	C	26-Jan-02	4	16.725	0.0004	0	0.0022
18	C	23-Jan-02	4	16.742	0.0002	0	0.0015
19*	C	16-Jan-02	3	16.775	0.0048	0.03	0.0286
19	C	10-Jan-02	3	16.8	0.0028	0.02	0.0165
20	C	16-Jan-02	3	16.775	0.0011	0.01	0.0065
20	C	10-Jan-02	3	16.808	0.0013	0.01	0.008
20	C	26-Jan-02	3	16.783	0.0015	0.01	0.0088
21	C	10-Jan-02	3	16.825	0.0005	0	0.0027
21	C	26-Jan-02	3	16.608	0	0	0.0002
21	C	6-Jan-02	3	16.858	0.0019	0.01	0.0111
22	C	5-Jan-02	4	16.883	0.0002	0	0.001
22	C	10-Jan-02	4	16.817	0.0005	0	0.003
22	C	6-Jan-02	4	16.65	0	0	0.0001
23	C	5-Jan-02	4	16.692	0.0004	0	0.0026
23	C	10-Jan-02	4	16.833	0.0004	0	0.0024
23	C	6-Jan-02	4	16.842	0	0	0.0001
24	C	5-Jan-02	4	16.783	0.002	0.01	0.0117
24	C	10-Jan-02	4	16.808	0.0012	0.01	0.0072
24	C	6-Jan-02	4	16.833	0.0015	0.01	0.0091
25	C	5-Jan-02	5	16.808	0.0039	0.02	0.0234
25	C	10-Jan-02	5	16.808	0.0011	0.01	0.0063
25	C	28-Jan-02	5	16.767	0.0004	0	0.0025
26	C	10-Jan-02	5	16.833	0.0003	0	0.0019
26	C	28-Jan-02	5	16.758	0.0007	0	0.0039
26	C	23-Jan-02	5	16.733	0.0002	0	0.0015
27	C	10-Jan-02	5	16.817	0.0008	0.01	0.0049
27	C	28-Jan-02	5	16.75	0.0007	0	0.0041
27	C	23-Jan-02	5	16.75	0.0006	0	0.0034
28	C	5-Jan-02	6	16.658	0.0001	0	0.0004
28	C	10-Jan-02	6	16.817	0.0003	0	0.0018
28	C	6-Jan-02	6	16.842	0.0002	0	0.001
29	C	5-Jan-02	6	16.858	0.0014	0.01	0.0086
29	C	10-Jan-02	6	16.8	0.002	0.01	0.0117
29	C	6-Jan-02	6	16.825	0.0004	0	0.0024
30	C	5-Jan-02	6	16.892	0.0006	0	0.0034
30	C	10-Jan-02	6	16.825	0.0003	0	0.0018
30	C	6-Jan-02	6	16.733	0	0	0.0003

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
31	C	5-Jan-02	5	16.833	0.0037	0.02	0.0221
31	C	10-Jan-02	5	16.808	0.0014	0.01	0.0083
31	C	28-Jan-02	5	16.767	0.0004	0	0.0023
32	C	10-Jan-02	5	16.842	0.0002	0	0.001
32	C	28-Jan-02	5	16.742	0.0003	0	0.0015
32	C	23-Jan-02	5	16.742	0.0001	0	0.0009
33	C	10-Jan-02	5	16.825	0.0003	0	0.002
33	C	28-Jan-02	5	16.742	0.0001	0	0.0005
33	C	23-Jan-02	5	16.758	0.0001	0	0.0004
34	C	5-Jan-02	8	16.917	0	0	0.0002
34	C	10-Jan-02	8	N/D	N/D	N/D	N/D
34	C	6-Jan-02	8	16.675	0.0001	0	0.0007
35	C	5-Jan-02	8	16.867	0.0005	0	0.0027
35	C	10-Jan-02	8	16.817	0.0011	0.01	0.0067
35	C	6-Jan-02	8	16.858	0.0003	0	0.0021
36	C	5-Jan-02	8	16.717	0.0002	0	0.001
36	C	10-Jan-02	8	N/D	N/D	N/D	N/D
36	C	6-Jan-02	8	16.917	0	0	0.0001
37	C	5-Jan-02	7	16.817	0.0011	0.01	0.0066
37	C	10-Jan-02	7	16.808	0.003	0.02	0.0178
37	C	28-Jan-02	7	N/D	N/D	N/D	N/D
37	C	6-Jan-02	7	16.842	0.002	0.01	0.0122
38	C	10-Jan-02	7	16.825	0.0003	0	0.002
38	C	28-Jan-02	7	16.733	0.0005	0	0.0027
38	C	6-Jan-02	7	16.683	0	0	0.0001
39	C	10-Jan-02	7	16.825	0.0022	0.02	0.0133
39	C	28-Jan-02	7	16.75	0.0006	0	0.0036
39	C	23-Jan-02	7	16.758	0.0003	0	0.0018
40	C	10-Jan-02	8	16.817	0.0001	0	0.0003
40	C	28-Jan-02	8	16.75	0.0002	0	0.0012
40	C	23-Jan-02	8	16.758	0.0001	0	0.0004
41	C	10-Jan-02	8	16.733	0.0003	0	0.0016
41	C	28-Jan-02	8	16.742	0.0002	0	0.0009
41	C	6-Jan-02	8	16.842	0	0	0.0001
42	C	10-Jan-02	8	16.817	0.0004	0	0.0024
42	C	28-Jan-02	8	16.742	0.0006	0.01	0.0036
42	C	23-Jan-02	8	16.758	0.0004	0	0.0025
43	C	10-Jan-02	9	16.8	0.001	0.01	0.0058
43	C	28-Jan-02	9	16.767	0.0011	0.01	0.0065
43	C	6-Jan-02	9	16.842	0.0022	0.01	0.013
44	C	10-Jan-02	9	16.808	0.0023	0.02	0.0135
44	C	28-Jan-02	9	16.75	0.0002	0	0.0012
44	C	23-Jan-02	9	16.75	0.0006	0	0.0038
45	C	10-Jan-02	9	16.808	0.0011	0.01	0.0066

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
45	C	28-Jan-02	9	16.75	0.0004	0	0.0022
45	C	23-Jan-02	9	16.758	0.0003	0	0.0015
46	C	28-Jan-02	10	N/D	N/D	N/D	N/D
46	C	10-Jan-02	10	16.725	0.0001	0	0.0004
46	C	23-Jan-02	10	16.742	0	0	0.0002
47	C	28-Jan-02	10	16.733	0.0011	0.01	0.0066
47	C	10-Jan-02	10	16.808	0.0007	0	0.0044
47	C	23-Jan-02	10	16.75	0.001	0.01	0.0061
48	C	28-Jan-02	10	16.725	0.0003	0	0.0016
48	C	10-Jan-02	10	16.8	0.0003	0	0.0017
48	C	6-Jan-02	10	16.825	0.0005	0	0.0028
49	C	28-Jan-02	11	16.742	0.0004	0	0.0024
49	C	10-Jan-02	11	16.808	0.0009	0.01	0.0056
49	C	6-Jan-02	11	16.792	0.0007	0.01	0.004
50	C	28-Jan-02	11	16.742	0.0009	0.01	0.0053
50	C	10-Jan-02	11	16.817	0.0007	0	0.0039
50	C	6-Jan-02	11	16.825	0.0001	0	0.0005
51	C	28-Jan-02	11	16.742	0.0013	0.01	0.0076
51	C	10-Jan-02	11	16.808	0.0013	0.01	0.008
51	C	6-Jan-02	11	16.808	0.0014	0.01	0.0086
52	C	28-Jan-02	12	16.742	0.0004	0	0.0026
52	C	10-Jan-02	12	16.808	0.0008	0.01	0.0045
52	C	23-Jan-02	12	16.75	0.0009	0.01	0.0054
53	C	28-Jan-02	12	16.742	0.0037	0.03	0.0223
53	C	10-Jan-02	12	16.808	0.0005	0	0.0032
53	C	23-Jan-02	12	16.75	0.0006	0	0.0038
54	C	28-Jan-02	12	16.742	0.001	0.01	0.0057
54	C	10-Jan-02	12	16.808	0.0018	0.01	0.0105
54	C	23-Jan-02	12	16.75	0.0007	0	0.0045
55	C	28-Jan-02	13	16.742	0.0006	0	0.0037
55	C	10-Jan-02	13	16.8	0.0003	0	0.0021
55	C	23-Jan-02	13	16.758	0.0006	0	0.0034
56	C	28-Jan-02	13	16.733	0.0007	0.01	0.0045
56	C	10-Jan-02	13	16.742	0.0021	0.06	0.0125
56	C	23-Jan-02	13	16.75	0.0005	0	0.0033
57	C	28-Jan-02	13	16.742	0.0011	0.01	0.0066
57	C	10-Jan-02	13	16.808	0.0006	0	0.0035
57	C	23-Jan-02	13	16.75	0.0008	0.01	0.005
58	C	28-Jan-02	12	16.733	0.0007	0.01	0.0043
58	C	10-Jan-02	12	16.808	0.001	0.01	0.006
58	C	23-Jan-02	12	16.75	0.0007	0	0.0045
59	C	28-Jan-02	12	16.742	0.0004	0	0.0022
59	C	10-Jan-02	12	16.8	0.0009	0.01	0.0053
59	C	23-Jan-02	12	16.75	0.0007	0	0.004

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
60	C	28-Jan-02	12	16.733	0.0017	0.01	0.0104
60	C	10-Jan-02	12	16.792	0.0003	0	0.0018
60	C	6-Jan-02	12	16.775	0.0008	0	0.0051
61	C	28-Jan-02	13	16.733	0.0007	0	0.0041
61	C	10-Jan-02	13	16.808	0.0003	0	0.0019
61	C	23-Jan-02	13	16.742	0.0008	0.01	0.005
62	C	28-Jan-02	13	16.742	0.0007	0	0.0039
62	C	10-Jan-02	13	16.8	0.001	0.01	0.006
62	C	23-Jan-02	13	16.75	0.0007	0	0.0044
63	C	28-Jan-02	13	16.733	0.0005	0	0.0027
63	C	10-Jan-02	13	16.792	0.0006	0	0.0035
63	C	23-Jan-02	13	16.742	0.0006	0	0.0036
64	C	28-Jan-02	14	16.742	0.0006	0	0.0034
64	C	10-Jan-02	14	16.808	0.0005	0	0.0031
64	C	23-Jan-02	14	16.75	0.0004	0	0.0024
65	C	28-Jan-02	14	16.742	0.0008	0.01	0.0049
65	C	10-Jan-02	14	16.8	0.0008	0.01	0.0047
65	C	23-Jan-02	14	16.75	0.0006	0	0.0036
66	C	28-Jan-02	14	16.733	0.0003	0	0.0018
66	C	10-Jan-02	14	16.792	0.0005	0	0.0029
66	C	23-Jan-02	14	16.75	0.0002	0	0.0013

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix AN: Nitrite, Field Blanks, Influent and Effluent

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
Blank	BLANK	10-Jan-02	B	N/D	N/D	N/D	N/D
Blank	BLANK	26-Jan-02	B	16.825	0	0	0.0003
Blank	BLANK	28-Jan-02	B	N/D	N/D	N/D	N/D
Influent	INFLUENT	5-Jan-02	I	16.675	0	0	0.0001
Influent	INFLUENT	10-Jan-02	I	16.808	0.0002	0	0.0013
Influent	INFLUENT	6-Jan-02	I	16.817	0.0008	0	0.0047
Effluent	EFFLUENT	5-Jan-02	E	16.842	0.0034	0.02	0.02
Effluent	EFFLUENT	10-Jan-02	E	16.817	0.0076	0.05	0.0456
Effluent	EFFLUENT	6-Jan-02	E	16.825	0.0037	0.02	0.0223

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix AO: Propionate, Strata A

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	A	16-Jan-02	1	N/D	N/D	N/D	N/D
1	A	17-Jan-02	1	N/D	N/D	N/D	N/D
1	A	23-Jan-02	1	N/D	N/D	N/D	N/D
2	A	16-Jan-02	1	10.008	0.0004	0	0.0157
2	A	17-Jan-02	1	N/D	N/D	N/D	N/D
2	A	23-Jan-02	1	10.342	0	0	0.0005
3	A	18-Jan-02	1	9.908	0.0001	0	0.0022
3	A	16-Jan-02	1	9.958	0.0036	0.01	0.142
3	A	17-Jan-02	1	9.917	0.001	0	0.0371
4	A	18-Jan-02	2	9.967	0.0004	0	0.0163
4	A	16-Jan-02	2	10	0.0009	0	0.037
4	A	17-Jan-02	2	9.917	0.0001	0	0.0057
5	A	18-Jan-02	2	9.95	0.0048	0.01	0.1873
5	A	16-Jan-02	2	9.958	0.0063	0.02	0.2462
5	A	17-Jan-02	2	9.917	0.004	0.01	0.1543
6	A	18-Jan-02	2	9.942	0.0005	0	0.0194
6	A	16-Jan-02	2	9.958	0.0012	0	0.0457
6	A	17-Jan-02	2	9.908	0.0009	0	0.0342
7	A	17-Jan-02	1	9.983	0.0002	0	0.007
7	A	23-Jan-02	1	N/D	N/D	N/D	N/D
8	A	18-Jan-02	1	10.3	0	0	0.0005
8	A	16-Jan-02	1	9.875	0	0	0.0004
8	A	17-Jan-02	1	N/D	N/D	N/D	N/D
9	A	18-Jan-02	1	9.992	0	0	0.0009
9	A	16-Jan-02	1	N/D	N/D	N/D	N/D
9	A	17-Jan-02	1	N/D	N/D	N/D	N/D
10	A	18-Jan-02	2	N/D	N/D	N/D	N/D
10	A	10-Jan-02	2	10.117	0	0	0.0005
10	A	16-Jan-02	2	N/D	N/D	N/D	N/D
10	A	14-Jan-02	2	10.367	0	0	0.0007
11	A	18-Jan-02	2	9.925	0.0005	0	0.0197
11	A	10-Jan-02	2	10.308	0	0	0.0007
11	A	16-Jan-02	2	9.992	0.0005	0	0.0198
11	A	14-Jan-02	2	10.092	0.0006	0	0.0232
12	A	18-Jan-02	2	9.933	0	0	0.0014
12	A	10-Jan-02	2	9.942	0	0	0.0005
12	A	16-Jan-02	2	9.967	0.0002	0	0.0087
13	A	18-Jan-02	3	9.95	0.0064	0.02	0.2488
13	A	16-Jan-02	3	9.942	0.0104	0.03	0.4068
13*	A	17-Jan-02	3	9.933	0.016	0.05	0.6228
14	A	18-Jan-02	3	9.917	0.002	0.01	0.0775
14	A	23-Jan-02	3	9.917	0.0016	0.01	0.0619
14	A	14-Jan-02	3	10.083	0.0021	0.01	0.0809

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
15	A	18-Jan-02	3	9.917	0.001	0	0.0396
15	A	17-Jan-02	3	9.942	0.0012	0	0.0449
15	A	23-Jan-02	3	9.925	0.0005	0	0.0202
16	A	18-Jan-02	4	N/D	N/D	N/D	N/D
16	A	10-Jan-02	4	N/D	N/D	N/D	N/D
16	A	23-Jan-02	4	N/D	N/D	N/D	N/D
17	A	17-Jan-02	4	9.908	0	0	0.0008
17	A	18-Jan-02	4	N/D	N/D	N/D	N/D
17	A	23-Jan-02	4	N/D	N/D	N/D	N/D
18	A	18-Jan-02	4	10.058	0.0014	0	0.0556
18	A	23-Jan-02	4	9.95	0.001	0	0.0373
18	A	14-Jan-02	4	10.117	0.0013	0	0.0488
19	A	17-Jan-02	3	9.933	0.0033	0.01	0.1283
19	A	18-Jan-02	3	9.983	0.0036	0.01	0.1423
19	A	24-Jan-02	3	9.892	0.0027	0.01	0.1058
20	A	10-Jan-02	3	10.025	0	0	0.0005
20	A	18-Jan-02	3	10.283	0	0	0.0015
20	A	23-Jan-02	3	N/D	N/D	N/D	N/D
21	A	10-Jan-02	3	10.117	0	0	0.0016
21	A	18-Jan-02	3	N/D	N/D	N/D	N/D
21	A	23-Jan-02	3	9.975	0	0	0.0018
22	A	10-Jan-02	4	10.083	0	0	0.0009
22	A	18-Jan-02	4	N/D	N/D	N/D	N/D
22	A	23-Jan-02	4	N/D	N/D	N/D	N/D
23	A	10-Jan-02	4	10.225	0	0	0.0006
23	A	18-Jan-02	4	N/D	N/D	N/D	N/D
23	A	14-Jan-02	4	N/D	N/D	N/D	N/D
24	A	10-Jan-02	4	9.983	0	0	0.0012
24	A	18-Jan-02	4	N/D	N/D	N/D	N/D
24	A	14-Jan-02	4	9.992	0	0	0.0007
25	A	10-Jan-02	5	9.983	0	0	0.0005
25	A	18-Jan-02	5	N/D	N/D	N/D	N/D
25	A	23-Jan-02	5	N/D	N/D	N/D	N/D
26	A	17-Jan-02	5	N/D	N/D	N/D	N/D
26	A	18-Jan-02	5	N/D	N/D	N/D	N/D
26	A	23-Jan-02	5	N/D	N/D	N/D	N/D
27	A	18-Jan-02	5	9.95	0.0011	0	0.041
27	A	23-Jan-02	5	9.95	0.0006	0	0.0251
27	A	14-Jan-02	5	10.05	0.0007	0	0.0266
28	A	10-Jan-02	6	9.933	0	0	0.0008
28	A	18-Jan-02	6	9.9	0.0001	0	0.0041
28	A	23-Jan-02	6	N/D	N/D	N/D	N/D
29	A	10-Jan-02	6	N/D	N/D	N/D	N/D
29	A	18-Jan-02	6	N/D	N/D	N/D	N/D



Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
29	A	23-Jan-02	6	10.133	0.0001	0	0.0024
30	A	10-Jan-02	6	N/D	N/D	N/D	N/D
30	A	18-Jan-02	6	N/D	N/D	N/D	N/D
30	A	24-Jan-02	6	N/D	N/D	N/D	N/D
31	A	10-Jan-02	5	10.192	0	0	0.0003
31	A	18-Jan-02	5	9.967	0.0004	0	0.0156
31	A	14-Jan-02	5	10.125	0	0	0.0005
32	A	17-Jan-02	5	N/D	N/D	N/D	N/D
32	A	18-Jan-02	5	N/D	N/D	N/D	N/D
32	A	23-Jan-02	5	N/D	N/D	N/D	N/D
33	A	18-Jan-02	5	N/D	N/D	N/D	N/D
33	A	23-Jan-02	5	N/D	N/D	N/D	N/D
33	A	14-Jan-02	5	N/D	N/D	N/D	N/D
34	A	22-Jan-02	8	N/D	N/D	N/D	N/D
34	A	10-Jan-02	8	10.208	0	0	0.0004
34	A	24-Jan-02	8	N/D	N/D	N/D	N/D
35	A	22-Jan-02	8	N/D	N/D	N/D	N/D
35	A	10-Jan-02	8	10.108	0	0	0.0004
35	A	24-Jan-02	8	N/D	N/D	N/D	N/D
36	A	17-Jan-02	8	N/D	N/D	N/D	N/D
36	A	22-Jan-02	8	10.192	0	0	0.0007
36	A	24-Jan-02	8	N/D	N/D	N/D	N/D
37	A	22-Jan-02	7	10.075	0.0004	0	0.0164
37	A	10-Jan-02	7	10.058	0.0009	0	0.0343
37	A	24-Jan-02	7	N/D	N/D	N/D	N/D
38	A	22-Jan-02	7	10.025	0.0001	0	0.0032
38	A	10-Jan-02	7	10.058	0.0001	0	0.0025
38	A	24-Jan-02	7	N/D	N/D	N/D	N/D
39	A	17-Jan-02	7	N/D	N/D	N/D	N/D
39	A	22-Jan-02	7	N/D	N/D	N/D	N/D
39	A	24-Jan-02	7	N/D	N/D	N/D	N/D
40	A	17-Jan-02	8	N/D	N/D	N/D	N/D
40	A	22-Jan-02	8	N/D	N/D	N/D	N/D
40	A	24-Jan-02	8	N/D	N/D	N/D	N/D
41	A	22-Jan-02	8	N/D	N/D	N/D	N/D
41	A	10-Jan-02	8	N/D	N/D	N/D	N/D
41	A	24-Jan-02	8	N/D	N/D	N/D	N/D
42	A	17-Jan-02	8	N/D	N/D	N/D	N/D
42	A	22-Jan-02	8	N/D	N/D	N/D	N/D
42	A	24-Jan-02	8	N/D	N/D	N/D	N/D
43	A	22-Jan-02	9	9.967	0.0003	0	0.0132
43	A	10-Jan-02	9	10.025	0	0	0.0017
43	A	14-Jan-02	9	N/D	N/D	N/D	N/D
44	A	22-Jan-02	9	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
44	A	10-Jan-02	9	9.975	0	0	0.0006
44	A	14-Jan-02	9	9.875	0.0002	0	0.006
45	A	22-Jan-02	9	N/D	N/D	N/D	N/D
45	A	10-Jan-02	9	10.267	0	0	0.0004
45	A	24-Jan-02	9	N/D	N/D	N/D	N/D
46	A	17-Jan-02	10	N/D	N/D	N/D	N/D
46	A	22-Jan-02	10	N/D	N/D	N/D	N/D
46	A	24-Jan-02	10	N/D	N/D	N/D	N/D
47	A	17-Jan-02	10	9.975	0.0115	0.03	0.4466
47*	A	22-Jan-02	10	9.908	0.02	0.06	0.7816
47	A	24-Jan-02	10	9.9	0.0079	0.02	0.3077
48	A	22-Jan-02	10	N/D	N/D	N/D	N/D
48	A	10-Jan-02	10	N/D	N/D	N/D	N/D
48	A	14-Jan-02	10	N/D	N/D	N/D	N/D
49	A	22-Jan-02	11	9.917	0.0009	0	0.0346
49	A	10-Jan-02	11	9.917	0.0013	0	0.0511
49	A	24-Jan-02	11	N/D	N/D	N/D	N/D
50	A	22-Jan-02	11	N/D	N/D	N/D	N/D
50	A	10-Jan-02	11	10.142	0	0	0.0006
50	A	24-Jan-02	11	N/D	N/D	N/D	N/D
51	A	22-Jan-02	11	N/D	N/D	N/D	N/D
51	A	10-Jan-02	11	10.225	0	0	0.0006
51	A	24-Jan-02	11	N/D	N/D	N/D	N/D
52	A	17-Jan-02	12	N/D	N/D	N/D	N/D
52	A	22-Jan-02	12	N/D	N/D	N/D	N/D
52	A	24-Jan-02	12	N/D	N/D	N/D	N/D
53	A	17-Jan-02	12	N/D	N/D	N/D	N/D
53	A	22-Jan-02	12	N/D	N/D	N/D	N/D
53	A	24-Jan-02	12	N/D	N/D	N/D	N/D
54	A	22-Jan-02	12	9.892	0	0	0.0006
54	A	10-Jan-02	12	N/D	N/D	N/D	N/D
54	A	24-Jan-02	12	N/D	N/D	N/D	N/D
55	A	22-Jan-02	13	9.925	0	0	0.0004
55	A	10-Jan-02	13	9.95	0	0	0.0007
55	A	24-Jan-02	13	N/D	N/D	N/D	N/D
56	A	17-Jan-02	13	N/D	N/D	N/D	N/D
56	A	22-Jan-02	13	9.908	0	0	0.0009
56	A	24-Jan-02	13	N/D	N/D	N/D	N/D
57	A	22-Jan-02	13	N/D	N/D	N/D	N/D
57	A	10-Jan-02	13	9.925	0	0	0.0012
57	A	24-Jan-02	13	N/D	N/D	N/D	N/D
58	A	22-Jan-02	12	9.925	0	0	0.0005
58	A	10-Jan-02	12	10.067	0	0	0.001
58	A	24-Jan-02	12	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
59	A	22-Jan-02	12	N/D	N/D	N/D	N/D
59	A	10-Jan-02	12	10.15	0	0	0.0006
59	A	24-Jan-02	12	N/D	N/D	N/D	N/D
60	A	22-Jan-02	12	9.933	0.0023	0.01	0.0893
60	A	10-Jan-02	12	9.858	0.0036	0.01	0.14
60	A	14-Jan-02	12	9.975	0.0024	0.01	0.0953
61	A	22-Jan-02	13	9.917	0.0017	0.01	0.0657
61	A	10-Jan-02	13	9.883	0.0038	0.01	0.1491
61	A	14-Jan-02	13	9.983	0.0016	0.01	0.0624
62*	A	22-Jan-02	13	9.933	0.0162	0.05	0.6332
62*	A	10-Jan-02	13	9.875	0.0194	0.06	0.7549
62	A	24-Jan-02	13	N/D	N/D	N/D	N/D
63	A	22-Jan-02	13	9.967	0.0034	0.01	0.134
63	A	10-Jan-02	13	9.883	0.0107	0.03	0.4159
63*	A	14-Jan-02	13	9.95	0.0132	0.04	0.5158
64	A	22-Jan-02	14	N/D	N/D	N/D	N/D
64	A	10-Jan-02	14	9.883	0.001	0	0.0408
64	A	24-Jan-02	14	N/D	N/D	N/D	N/D
65	A	17-Jan-02	14	N/D	N/D	N/D	N/D
65	A	22-Jan-02	14	N/D	N/D	N/D	N/D
65	A	24-Jan-02	14	N/D	N/D	N/D	N/D
66	A	17-Jan-02	14	10.183	0	0	0.0003
66	A	23-Jan-02	14	9.883	0.0008	0	0.0318
66	A	24-Jan-02	14	N/D	N/D	N/D	N/D

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix AP: Propionate, Strata B

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	B	25-Jan-02	1	10.133	0.0035	0.01	0.1487
1	B	17-Jan-02	1	10	0.0016	0.01	0.067
1*	B	15-Jan-02	1	10.125	0.0042	0.01	0.1779
2	B	25-Jan-02	1	N/D	N/D	N/D	N/D
2	B	13-Jan-02	1	N/D	N/D	N/D	N/D
2	B	15-Jan-02	1	N/D	N/D	N/D	N/D
3	B	25-Jan-02	1	10.017	0.0009	0	0.0381
3	B	13-Jan-02	1	10.125	0.0016	0.01	0.0673
3	B	15-Jan-02	1	10.1	0.0019	0.01	0.0784
4	B	25-Jan-02	2	N/D	N/D	N/D	N/D
4	B	13-Jan-02	2	N/D	N/D	N/D	N/D
4	B	15-Jan-02	2	N/D	N/D	N/D	N/D
5	B	25-Jan-02	2	9.983	0	0	0.0008
5	B	17-Jan-02	2	N/D	N/D	N/D	N/D
5	B	15-Jan-02	2	N/D	N/D	N/D	N/D
6	B	25-Jan-02	2	N/D	N/D	N/D	N/D
6	B	13-Jan-02	2	N/D	N/D	N/D	N/D
6	B	15-Jan-02	2	N/D	N/D	N/D	N/D
7	B	25-Jan-02	1	N/D	N/D	N/D	N/D
7	B	17-Jan-02	1	N/D	N/D	N/D	N/D
7	B	15-Jan-02	1	N/D	N/D	N/D	N/D
8	B	25-Jan-02	1	N/D	N/D	N/D	N/D
8	B	13-Jan-02	1	N/D	N/D	N/D	N/D
8	B	15-Jan-02	1	N/D	N/D	N/D	N/D
9	B	25-Jan-02	1	N/D	N/D	N/D	N/D
9	B	13-Jan-02	1	N/D	N/D	N/D	N/D
9	B	15-Jan-02	1	N/D	N/D	N/D	N/D
10	B	25-Jan-02	2	N/D	N/D	N/D	N/D
10	B	13-Jan-02	2	10.267	0	0	0.0012
10	B	15-Jan-02	2	10.175	0	0	0.0011
11	B	25-Jan-02	2	9.9	0.0006	0	0.0253
11	B	13-Jan-02	2	10.025	0	0	0.0006
11	B	15-Jan-02	2	10.042	0	0	0.0002
12	B	25-Jan-02	2	N/D	N/D	N/D	N/D
12	B	13-Jan-02	2	N/D	N/D	N/D	N/D
12	B	15-Jan-02	2	9.925	0	0	0.0006
13	B	17-Jan-02	3	9.892	0.0001	0	0.0042
14	B	25-Jan-02	3	10.167	0	0	0.0012
14	B	13-Jan-02	3	N/D	N/D	N/D	N/D
14	B	15-Jan-02	3	N/D	N/D	N/D	N/D
15	B	25-Jan-02	3	N/D	N/D	N/D	N/D
15	B	13-Jan-02	3	N/D	N/D	N/D	N/D
15	B	15-Jan-02	3	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
16	B	25-Jan-02	4	N/D	N/D	N/D	N/D
16	B	13-Jan-02	4	N/D	N/D	N/D	N/D
16	B	15-Jan-02	4	10.208	0	0	0.0007
17	B	25-Jan-02	4	N/D	N/D	N/D	N/D
17	B	17-Jan-02	4	N/D	N/D	N/D	N/D
17	B	15-Jan-02	4	10.15	0	0	0.0019
18	B	25-Jan-02	4	9.908	0.0019	0.01	0.0784
18	B	17-Jan-02	4	9.875	0.0017	0.01	0.0713
18	B	15-Jan-02	4	9.967	0.0035	0.01	0.1478
19	B	25-Jan-02	3	N/D	N/D	N/D	N/D
19	B	17-Jan-02	3	N/D	N/D	N/D	N/D
19	B	16-Jan-02	3	9.95	0.0019	0.01	0.0806
20	B	25-Jan-02	3	N/D	N/D	N/D	N/D
20	B	13-Jan-02	3	N/D	N/D	N/D	N/D
20	B	15-Jan-02	3	N/D	N/D	N/D	N/D
21	B	25-Jan-02	3	N/D	N/D	N/D	N/D
21	B	13-Jan-02	3	N/D	N/D	N/D	N/D
21	B	15-Jan-02	3	N/D	N/D	N/D	N/D
22	B	25-Jan-02	4	N/D	N/D	N/D	N/D
22	B	13-Jan-02	4	N/D	N/D	N/D	N/D
22	B	15-Jan-02	4	N/D	N/D	N/D	N/D
23	B	25-Jan-02	4	N/D	N/D	N/D	N/D
23	B	13-Jan-02	4	N/D	N/D	N/D	N/D
23	B	15-Jan-02	4	N/D	N/D	N/D	N/D
24	B	25-Jan-02	4	9.908	0.0002	0	0.009
24	B	13-Jan-02	4	9.983	0	0	0.002
24	B	15-Jan-02	4	N/D	N/D	N/D	N/D
25	B	25-Jan-02	5	N/D	N/D	N/D	N/D
25	B	13-Jan-02	5	N/D	N/D	N/D	N/D
25	B	15-Jan-02	5	N/D	N/D	N/D	N/D
26	B	25-Jan-02	5	N/D	N/D	N/D	N/D
26	B	13-Jan-02	5	10	0.0002	0.01	0.0091
26	B	15-Jan-02	5	N/D	N/D	N/D	N/D
27	B	25-Jan-02	5	N/D	N/D	N/D	N/D
27	B	13-Jan-02	5	9.983	0	0	0.0006
27	B	15-Jan-02	5	N/D	N/D	N/D	N/D
28	B	25-Jan-02	6	9.917	0.0003	0	0.0135
28	B	13-Jan-02	6	9.892	0	0	0.0006
28	B	15-Jan-02	6	N/D	N/D	N/D	N/D
29	B	25-Jan-02	6	N/D	N/D	N/D	N/D
29	B	13-Jan-02	6	N/D	N/D	N/D	N/D
29	B	15-Jan-02	6	N/D	N/D	N/D	N/D
30	B	25-Jan-02	6	N/D	N/D	N/D	N/D
30	B	13-Jan-02	6	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
30	B	15-Jan-02	6	N/D	N/D	N/D	N/D
31*	B	25-Jan-02	5	9.875	0.0052	0.02	0.2193
31	B	13-Jan-02	5	9.992	0.0038	0.01	0.1614
31*	B	15-Jan-02	5	9.975	0.0061	0.02	0.2577
32	B	13-Jan-02	5	9.983	0.0012	0	0.0509
32	B	15-Jan-02	5	9.925	0.0013	0	0.0552
32	B	16-Jan-02	5	N/D	N/D	N/D	N/D
33	B	25-Jan-02	5	9.933	0	0	0.0014
33	B	13-Jan-02	5	N/D	N/D	N/D	N/D
33	B	15-Jan-02	5	10.025	0	0	0.0011
34	B	16-Jan-02	8	10.042	0	0	0.0009
34	B	26-Jan-02	8	10.133	0	0	0.0004
34	B	13-Jan-02	8	10.192	0.0002	0	0.0098
35	B	16-Jan-02	8	10.108	0.0008	0	0.0333
35	B	26-Jan-02	8	10.1	0.0007	0	0.0306
35	B	13-Jan-02	8	10.192	0.0004	0	0.0166
36	B	16-Jan-02	8	N/D	N/D	N/D	N/D
36	B	26-Jan-02	8	10.15	0	0	0.0009
36	B	13-Jan-02	8	10.083	0	0	0.0012
37	B	26-Jan-02	7	N/D	N/D	N/D	N/D
37	B	13-Jan-02	7	10.158	0	0	0.0013
37	B	23-Jan-02	7	10.058	0.0005	0	0.0204
38	B	16-Jan-02	7	10.158	0	0	0.0005
38	B	26-Jan-02	7	N/D	N/D	N/D	N/D
38	B	13-Jan-02	7	10.242	0	0	0.0006
39	B	16-Jan-02	7	N/D	N/D	N/D	N/D
39	B	26-Jan-02	7	9.925	0.0003	0	0.0129
39	B	13-Jan-02	7	10.017	0	0	0.0006
40	B	16-Jan-02	8	9.983	0.0007	0	0.0295
40	B	26-Jan-02	8	9.958	0.0011	0	0.0449
40	B	13-Jan-02	8	N/D	N/D	N/D	N/D
41	B	16-Jan-02	8	9.975	0	0	0.0009
41	B	26-Jan-02	8	N/D	N/D	N/D	N/D
41	B	13-Jan-02	8	10.4	0	0	0.001
42	B	16-Jan-02	8	N/D	N/D	N/D	N/D
42	B	26-Jan-02	8	N/D	N/D	N/D	N/D
42	B	13-Jan-02	8	N/D	N/D	N/D	N/D
43	B	16-Jan-02	9	N/D	N/D	N/D	N/D
43	B	26-Jan-02	9	N/D	N/D	N/D	N/D
43	B	13-Jan-02	9	10.1	0	0	0.001
44	B	16-Jan-02	9	N/D	N/D	N/D	N/D
44	B	26-Jan-02	9	N/D	N/D	N/D	N/D
44	B	13-Jan-02	9	N/D	N/D	N/D	N/D
45	B	16-Jan-02	9	9.983	0.0024	0.01	0.1003

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
45	B	26-Jan-02	9	9.925	0.0039	0.01	0.1655
45	B	13-Jan-02	9	10.033	0.0006	0	0.0253
46	B	16-Jan-02	10	N/D	N/D	N/D	N/D
46	B	26-Jan-02	10	10.008	0.0001	0	0.0035
46	B	13-Jan-02	10	N/D	N/D	N/D	N/D
47	B	16-Jan-02	10	9.975	0	0	0.0005
47	B	26-Jan-02	10	N/D	N/D	N/D	N/D
47	B	13-Jan-02	10	N/D	N/D	N/D	N/D
48	B	15-Jan-02	10	N/D	N/D	N/D	N/D
48	B	16-Jan-02	10	N/D	N/D	N/D	N/D
48	B	13-Jan-02	10	N/D	N/D	N/D	N/D
49	B	16-Jan-02	11	9.917	0.0018	0.01	0.0771
49	B	26-Jan-02	11	9.858	0.0004	0	0.0151
49	B	13-Jan-02	11	10	0.0037	0.01	0.158
50	B	26-Jan-02	11	N/D	N/D	N/D	N/D
50	B	13-Jan-02	11	10.017	0.001	0	0.0418
50	B	23-Jan-02	11	N/D	N/D	N/D	N/D
51	B	16-Jan-02	11	N/D	N/D	N/D	N/D
51	B	26-Jan-02	11	N/D	N/D	N/D	N/D
51	B	13-Jan-02	11	N/D	N/D	N/D	N/D
52	B	16-Jan-02	12	N/D	N/D	N/D	N/D
52	B	26-Jan-02	12	N/D	N/D	N/D	N/D
52	B	13-Jan-02	12	10.067	0	0	0.0004
53	B	16-Jan-02	12	N/D	N/D	N/D	N/D
53	B	26-Jan-02	12	10.042	0	0	0.0011
53	B	13-Jan-02	12	N/D	N/D	N/D	N/D
54	B	16-Jan-02	12	9.942	0.0001	0	0.0046
54	B	26-Jan-02	12	N/D	N/D	N/D	N/D
54	B	13-Jan-02	12	10.025	0	0	0.001
55	B	16-Jan-02	13	9.95	0	0	0.0002
55	B	26-Jan-02	13	N/D	N/D	N/D	N/D
55	B	13-Jan-02	13	N/D	N/D	N/D	N/D
56	B	15-Jan-02	13	N/D	N/D	N/D	N/D
56	B	16-Jan-02	13	N/D	N/D	N/D	N/D
57	B	16-Jan-02	13	N/D	N/D	N/D	N/D
57	B	26-Jan-02	13	N/D	N/D	N/D	N/D
57	B	13-Jan-02	13	N/D	N/D	N/D	N/D
58	B	16-Jan-02	12	N/D	N/D	N/D	N/D
58	B	26-Jan-02	12	N/D	N/D	N/D	N/D
58	B	13-Jan-02	12	N/D	N/D	N/D	N/D
59	B	16-Jan-02	12	10.233	0.0001	0	0.0026
59	B	26-Jan-02	12	9.908	0.0005	0	0.0201
59	B	13-Jan-02	12	9.983	0.0016	0.01	0.0681
60	B	16-Jan-02	12	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
60	B	26-Jan-02	12	N/D	N/D	N/D	N/D
60	B	13-Jan-02	12	10.225	0	0	0.0007
61	B	16-Jan-02	13	N/D	N/D	N/D	N/D
61	B	26-Jan-02	13	N/D	N/D	N/D	N/D
61	B	13-Jan-02	13	N/D	N/D	N/D	N/D
62	B	16-Jan-02	13	N/D	N/D	N/D	N/D
62	B	26-Jan-02	13	N/D	N/D	N/D	N/D
62	B	13-Jan-02	13	N/D	N/D	N/D	N/D
63	B	16-Jan-02	13	10.258	0	0	0.0005
63	B	26-Jan-02	13	9.9	0.0001	0	0.003
63	B	13-Jan-02	13	N/D	N/D	N/D	N/D
64	B	16-Jan-02	14	N/D	N/D	N/D	N/D
64	B	26-Jan-02	14	N/D	N/D	N/D	N/D
64	B	13-Jan-02	14	9.917	0	0	0.001
65	B	16-Jan-02	14	N/D	N/D	N/D	N/D
65	B	26-Jan-02	14	N/D	N/D	N/D	N/D
65	B	13-Jan-02	14	9.992	0	0	0.0008
66	B	16-Jan-02	14	9.925	0	0	0.0012
66	B	26-Jan-02	14	9.875	0.0002	0	0.01
66	B	13-Jan-02	14	9.942	0.0002	0	0.0087

\*—JMP 4.0 Outlier

N/D—Not Detected



### Appendix AQ: Propionate, Strata C

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	C	16-Jan-02	1	10.058	0	0	0.0004
1	C	17-Jan-02	1	N/D	N/D	N/D	N/D
1	C	26-Jan-02	1	N/D	N/D	N/D	N/D
2	C	16-Jan-02	1	N/D	N/D	N/D	N/D
2	C	17-Jan-02	1	N/D	N/D	N/D	N/D
2	C	26-Jan-02	1	N/D	N/D	N/D	N/D
3	C	16-Jan-02	1	N/D	N/D	N/D	N/D
3	C	17-Jan-02	1	N/D	N/D	N/D	N/D
3	C	26-Jan-02	1	N/D	N/D	N/D	N/D
4	C	16-Jan-02	2	N/D	N/D	N/D	N/D
4	C	17-Jan-02	2	N/D	N/D	N/D	N/D
4	C	26-Jan-02	2	N/D	N/D	N/D	N/D
5	C	16-Jan-02	2	N/D	N/D	N/D	N/D
5	C	17-Jan-02	2	N/D	N/D	N/D	N/D
5	C	26-Jan-02	2	N/D	N/D	N/D	N/D
7	C	16-Jan-02	1	N/D	N/D	N/D	N/D
7	C	26-Jan-02	1	10.158	0	0	0.0019
7	C	22-Jan-02	1	N/D	N/D	N/D	N/D
8	C	26-Jan-02	1	10.392	0	0	0.0008
8	C	23-Jan-02	1	N/D	N/D	N/D	N/D
8	C	22-Jan-02	1	N/D	N/D	N/D	N/D
9	C	16-Jan-02	1	N/D	N/D	N/D	N/D
9	C	26-Jan-02	1	10.325	0	0	0.0015
9	C	22-Jan-02	1	N/D	N/D	N/D	N/D
10	C	16-Jan-02	2	N/D	N/D	N/D	N/D
10	C	26-Jan-02	2	N/D	N/D	N/D	N/D
10	C	6-Jan-02	2	9.875	0	0	0.0006
11	C	16-Jan-02	2	N/D	N/D	N/D	N/D
11	C	26-Jan-02	2	N/D	N/D	N/D	N/D
11	C	6-Jan-02	2	10.092	0	0	0.0006
12	C	16-Jan-02	2	N/D	N/D	N/D	N/D
12	C	26-Jan-02	2	N/D	N/D	N/D	N/D
12	C	23-Jan-02	2	N/D	N/D	N/D	N/D
13	C	16-Jan-02	3	N/D	N/D	N/D	N/D
13	C	10-Jan-02	3	N/D	N/D	N/D	N/D
13	C	26-Jan-02	3	10.375	0	0	0.0006
14	C	10-Jan-02	3	N/D	N/D	N/D	N/D
14	C	26-Jan-02	3	N/D	N/D	N/D	N/D
14	C	23-Jan-02	3	N/D	N/D	N/D	N/D
15	C	10-Jan-02	3	N/D	N/D	N/D	N/D
15	C	26-Jan-02	3	N/D	N/D	N/D	N/D
15	C	23-Jan-02	3	N/D	N/D	N/D	N/D
16	C	10-Jan-02	4	9.917	0	0	0.0005

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
16	C	26-Jan-02	4	N/D	N/D	N/D	N/D
16	C	6-Jan-02	4	10.1	0.0001	0	0.0026
17	C	10-Jan-02	4	9.842	0	0	0.0004
17	C	26-Jan-02	4	10.317	0	0	0.0004
17	C	23-Jan-02	4	N/D	N/D	N/D	N/D
18	C	10-Jan-02	4	N/D	N/D	N/D	N/D
18	C	26-Jan-02	4	N/D	N/D	N/D	N/D
18	C	23-Jan-02	4	N/D	N/D	N/D	N/D
19	C	16-Jan-02	3	N/D	N/D	N/D	N/D
19	C	10-Jan-02	3	10.233	0	0	0.0004
20	C	16-Jan-02	3	N/D	N/D	N/D	N/D
20	C	10-Jan-02	3	N/D	N/D	N/D	N/D
20	C	26-Jan-02	3	10.008	0.0001	0	0.0032
21	C	10-Jan-02	3	N/D	N/D	N/D	N/D
21*	C	26-Jan-02	3	10.05	0.0002	0.01	0.0101
21	C	6-Jan-02	3	10.158	0	0	0.0013
22	C	5-Jan-02	4	10.083	0	0	0.0005
22	C	10-Jan-02	4	N/D	N/D	N/D	N/D
22	C	6-Jan-02	4	10.15	0	0	0.0014
23	C	5-Jan-02	4	10.075	0.0001	0	0.0029
23	C	10-Jan-02	4	N/D	N/D	N/D	N/D
23	C	6-Jan-02	4	10.033	0	0	0.0007
24	C	5-Jan-02	4	9.992	0	0	0.0007
24	C	10-Jan-02	4	N/D	N/D	N/D	N/D
24	C	6-Jan-02	4	N/D	N/D	N/D	N/D
25	C	5-Jan-02	5	10.242	0.0001	0	0.0029
25	C	10-Jan-02	5	N/D	N/D	N/D	N/D
25	C	28-Jan-02	5	N/D	N/D	N/D	N/D
26	C	10-Jan-02	5	N/D	N/D	N/D	N/D
26	C	28-Jan-02	5	9.85	0	0	0.0011
26	C	23-Jan-02	5	10.367	0	0	0.0005
27	C	10-Jan-02	5	N/D	N/D	N/D	N/D
27	C	28-Jan-02	5	N/D	N/D	N/D	N/D
27	C	23-Jan-02	5	N/D	N/D	N/D	N/D
28	C	5-Jan-02	6	N/D	N/D	N/D	N/D
28	C	10-Jan-02	6	N/D	N/D	N/D	N/D
28*	C	6-Jan-02	6	10.15	0.0001	0	0.0021
29	C	5-Jan-02	6	9.975	0	0	0.0016
29	C	10-Jan-02	6	10.1	0	0	0.0008
29	C	6-Jan-02	6	9.925	0	0	0.0009
30	C	5-Jan-02	6	10.175	0	0	0.0016
30	C	10-Jan-02	6	10.042	0	0	0.0004
30	C	6-Jan-02	6	10.175	0	0	0.0009
31	C	5-Jan-02	5	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
31	C	10-Jan-02	5	N/D	N/D	N/D	N/D
31	C	28-Jan-02	5	N/D	N/D	N/D	N/D
32	C	10-Jan-02	5	10.092	0	0	0.0009
32	C	28-Jan-02	5	N/D	N/D	N/D	N/D
32	C	23-Jan-02	5	10.233	0	0	0.0005
33	C	10-Jan-02	5	N/D	N/D	N/D	N/D
33	C	28-Jan-02	5	N/D	N/D	N/D	N/D
33	C	23-Jan-02	5	N/D	N/D	N/D	N/D
34	C	5-Jan-02	8	10.15	0	0	0.0011
34	C	10-Jan-02	8	10.025	0	0	0.0006
34	C	6-Jan-02	8	9.85	0	0	0.0008
35	C	5-Jan-02	8	9.975	0	0	0.0006
35	C	10-Jan-02	8	10.242	0	0	0.0005
35	C	6-Jan-02	8	10.075	0	0	0.0005
36	C	5-Jan-02	8	10.258	0	0	0.0011
36	C	10-Jan-02	8	10.292	0	0	0.0005
36	C	6-Jan-02	8	N/D	N/D	N/D	N/D
37	C	5-Jan-02	7	N/D	N/D	N/D	N/D
37	C	10-Jan-02	7	N/D	N/D	N/D	N/D
37	C	28-Jan-02	7	N/D	N/D	N/D	N/D
37	C	6-Jan-02	7	N/D	N/D	N/D	N/D
38	C	10-Jan-02	7	10.167	0	0	0.0015
38	C	28-Jan-02	7	N/D	N/D	N/D	N/D
38	C	6-Jan-02	7	9.992	0	0	0.0008
39	C	10-Jan-02	7	10.05	0	0	0.0009
39	C	28-Jan-02	7	N/D	N/D	N/D	N/D
39	C	23-Jan-02	7	N/D	N/D	N/D	N/D
40	C	10-Jan-02	8	N/D	N/D	N/D	N/D
40	C	28-Jan-02	8	N/D	N/D	N/D	N/D
40	C	23-Jan-02	8	N/D	N/D	N/D	N/D
41	C	10-Jan-02	8	10.1	0	0	0.0006
41	C	28-Jan-02	8	10.258	0	0	0.0005
41	C	6-Jan-02	8	10.083	0	0	0.001
42	C	10-Jan-02	8	N/D	N/D	N/D	N/D
42	C	28-Jan-02	8	N/D	N/D	N/D	N/D
42	C	23-Jan-02	8	9.975	0	0	0.0006
43	C	10-Jan-02	9	N/D	N/D	N/D	N/D
43	C	28-Jan-02	9	N/D	N/D	N/D	N/D
43	C	6-Jan-02	9	10.083	0	0	0.0012
44	C	10-Jan-02	9	N/D	N/D	N/D	N/D
44	C	28-Jan-02	9	N/D	N/D	N/D	N/D
44	C	23-Jan-02	9	N/D	N/D	N/D	N/D
45	C	10-Jan-02	9	N/D	N/D	N/D	N/D
45	C	28-Jan-02	9	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
45	C	23-Jan-02	9	N/D	N/D	N/D	N/D
46	C	28-Jan-02	10	N/D	N/D	N/D	N/D
46	C	10-Jan-02	10	N/D	N/D	N/D	N/D
46	C	23-Jan-02	10	N/D	N/D	N/D	N/D
47	C	28-Jan-02	10	N/D	N/D	N/D	N/D
47	C	10-Jan-02	10	10.4	0	0	0.0011
47	C	23-Jan-02	10	10.4	0	0	0.0006
48	C	28-Jan-02	10	N/D	N/D	N/D	N/D
48	C	10-Jan-02	10	10.133	0	0	0.0019
48	C	6-Jan-02	10	9.883	0	0	0.0011
49	C	28-Jan-02	11	N/D	N/D	N/D	N/D
49	C	10-Jan-02	11	N/D	N/D	N/D	N/D
49	C	6-Jan-02	11	10.1	0	0	0.001
50	C	28-Jan-02	11	N/D	N/D	N/D	N/D
50	C	10-Jan-02	11	N/D	N/D	N/D	N/D
50	C	6-Jan-02	11	10.258	0	0	0.0005
51	C	28-Jan-02	11	10.217	0	0	0.0006
51	C	10-Jan-02	11	N/D	N/D	N/D	N/D
51	C	6-Jan-02	11	10.158	0	0	0.0012
52	C	28-Jan-02	12	N/D	N/D	N/D	N/D
52	C	10-Jan-02	12	N/D	N/D	N/D	N/D
52	C	23-Jan-02	12	N/D	N/D	N/D	N/D
53	C	28-Jan-02	12	N/D	N/D	N/D	N/D
53	C	10-Jan-02	12	N/D	N/D	N/D	N/D
53	C	23-Jan-02	12	N/D	N/D	N/D	N/D
54	C	28-Jan-02	12	N/D	N/D	N/D	N/D
54	C	10-Jan-02	12	N/D	N/D	N/D	N/D
54	C	23-Jan-02	12	10.15	0	0	0.0006
55	C	28-Jan-02	13	10.075	0	0	0.0005
55	C	10-Jan-02	13	N/D	N/D	N/D	N/D
55	C	23-Jan-02	13	N/D	N/D	N/D	N/D
56	C	28-Jan-02	13	N/D	N/D	N/D	N/D
56	C	10-Jan-02	13	10.267	0	0	0.0005
56	C	23-Jan-02	13	N/D	N/D	N/D	N/D
57	C	28-Jan-02	13	N/D	N/D	N/D	N/D
57	C	10-Jan-02	13	10.242	0	0	0.0018
57	C	23-Jan-02	13	N/D	N/D	N/D	N/D
58	C	28-Jan-02	12	N/D	N/D	N/D	N/D
58*	C	10-Jan-02	12	10.042	0.0005	0	0.0209
58	C	23-Jan-02	12	N/D	N/D	N/D	N/D
59	C	28-Jan-02	12	N/D	N/D	N/D	N/D
59	C	10-Jan-02	12	N/D	N/D	N/D	N/D
59	C	23-Jan-02	12	N/D	N/D	N/D	N/D
60	C	28-Jan-02	12	10.35	0	0	0.0006

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
60	C	10-Jan-02	12	N/D	N/D	N/D	N/D
60	C	6-Jan-02	12	9.983	0	0	0.0007
61	C	28-Jan-02	13	N/D	N/D	N/D	N/D
61	C	10-Jan-02	13	N/D	N/D	N/D	N/D
61	C	23-Jan-02	13	N/D	N/D	N/D	N/D
62	C	28-Jan-02	13	N/D	N/D	N/D	N/D
62	C	10-Jan-02	13	N/D	N/D	N/D	N/D
62	C	23-Jan-02	13	N/D	N/D	N/D	N/D
63	C	28-Jan-02	13	N/D	N/D	N/D	N/D
63	C	10-Jan-02	13	N/D	N/D	N/D	N/D
63	C	23-Jan-02	13	N/D	N/D	N/D	N/D
64	C	28-Jan-02	14	N/D	N/D	N/D	N/D
64	C	10-Jan-02	14	9.85	0	0	0.0011
64	C	23-Jan-02	14	N/D	N/D	N/D	N/D
65	C	28-Jan-02	14	N/D	N/D	N/D	N/D
65	C	10-Jan-02	14	N/D	N/D	N/D	N/D
65	C	23-Jan-02	14	N/D	N/D	N/D	N/D
66	C	28-Jan-02	14	N/D	N/D	N/D	N/D
66	C	10-Jan-02	14	N/D	N/D	N/D	N/D
66	C	23-Jan-02	14	N/D	N/D	N/D	N/D

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix AR: Propionate, Field Blanks, Influent and Effluent

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
Blank	BLANK	10-Jan-02	B	N/D	N/D	N/D	N/D
Blank	BLANK	26-Jan-02	B	N/D	N/D	N/D	N/D
Blank	BLANK	28-Jan-02	B	N/D	N/D	N/D	N/D
Influent	INFLUENT	5-Jan-02	I	10.15	0	0	0.0009
Influent	INFLUENT	10-Jan-02	I	N/D	N/D	N/D	N/D
Influent	INFLUENT	6-Jan-02	I	10.142	0	0	0.0012
Effluent	EFFLUENT	5-Jan-02	E	10.15	0	0	0.001
Effluent	EFFLUENT	10-Jan-02	E	10.117	0.0023	0.01	0.0915
Effluent	EFFLUENT	6-Jan-02	E	10.183	0	0	0.0007

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix AS: Sulfate, Strata A

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	A	16-Jan-02	1	23.6	1.875	9.83	35.9344
1	A	17-Jan-02	1	23.6	1.9762	10.26	37.8742
1	A	23-Jan-02	1	23.575	2.021	10.64	38.7321
2	A	16-Jan-02	1	23.608	0.9293	4.2	17.8107
2	A	17-Jan-02	1	23.6	0.7931	3.53	15.1991
2	A	23-Jan-02	1	23.575	1.5233	8.11	29.1937
3	A	18-Jan-02	1	23.6	0.5368	1.73	10.2875
3	A	16-Jan-02	1	23.608	0.2102	1.21	4.0281
3	A	17-Jan-02	1	23.608	0.7634	2.85	14.6314
4	A	18-Jan-02	2	23.608	0.0545	0.32	1.0454
4	A	16-Jan-02	2	23.608	0.309	0.48	5.9226
4	A	17-Jan-02	2	23.608	0.0535	0.31	1.0245
5	A	18-Jan-02	2	23.583	0.3625	0.3	6.9473
5	A	16-Jan-02	2	23.583	0.382	0.33	7.3204
5	A	17-Jan-02	2	23.592	0.3724	0.31	7.1378
6	A	18-Jan-02	2	23.6	0.3474	0.48	6.6578
6	A	16-Jan-02	2	23.617	0.4008	0.47	7.6807
6	A	17-Jan-02	2	23.608	0.393	0.39	7.5312
7	A	17-Jan-02	1	23.608	0.4359	1.6	8.3533
7	A	23-Jan-02	1	23.592	0.1609	0.92	3.0831
8	A	18-Jan-02	1	23.592	0.3869	0.34	7.4148
8	A	16-Jan-02	1	23.608	0.4598	0.4	8.8114
8	A	17-Jan-02	1	23.6	0.3579	0.34	6.859
9	A	18-Jan-02	1	23.6	0.0859	0.49	1.6471
9	A	16-Jan-02	1	23.608	0.0674	0.39	1.2923
9	A	17-Jan-02	1	23.608	0.3319	1.14	6.3612
10	A	18-Jan-02	2	23.592	2.1958	11.67	42.0833
10	A	10-Jan-02	2	23.558	1.9758	10.52	37.8656
10	A	16-Jan-02	2	23.592	2.318	12.1	44.4244
10	A	14-Jan-02	2	23.6	1.4183	7.54	27.1821
11	A	18-Jan-02	2	23.575	0.3267	0.3	6.2613
11	A	10-Jan-02	2	23.6	0.0544	0.32	1.042
11	A	16-Jan-02	2	23.608	0.3837	0.4	7.3529
11	A	14-Jan-02	2	23.583	0.3438	0.29	6.5882
12	A	18-Jan-02	2	23.575	0.3612	0.29	6.9228
12	A	10-Jan-02	2	23.6	0.0078	0.05	0.149
12	A	16-Jan-02	2	23.592	0.401	0.33	7.6858
13	A	18-Jan-02	3	23.583	0.3207	0.26	6.1471
13	A	16-Jan-02	3	23.592	0.2891	0.26	5.5401
13	A	17-Jan-02	3	23.592	0.2649	0.26	5.0764
14	A	18-Jan-02	3	N/D	N/D	N/D	N/D
14	A	23-Jan-02	3	23.567	0.3955	0.34	7.5797
14	A	14-Jan-02	3	23.592	0.3201	0.26	6.1354

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
15	A	18-Jan-02	3	23.608	0.4097	0.53	7.8512
15	A	17-Jan-02	3	23.6	0.2409	0.24	4.6173
15	A	23-Jan-02	3	23.583	0.2571	0.26	4.9267
16	A	18-Jan-02	4	23.583	2.623	13.81	50.2697
16	A	10-Jan-02	4	23.608	2.6026	14.04	49.879
16	A	23-Jan-02	4	23.567	2.7033	14.25	51.8099
17	A	17-Jan-02	4	23.608	0.1134	0.65	2.1739
17	A	18-Jan-02	4	23.567	0.0807	0.47	1.5472
17	A	23-Jan-02	4	23.583	0.0684	0.4	1.3101
18	A	18-Jan-02	4	23.575	0.0901	0.52	1.7263
18	A	23-Jan-02	4	23.583	0.3808	0.55	7.2973
18	A	14-Jan-02	4	23.617	0.1571	0.23	3.0108
19	A	17-Jan-02	3	23.592	0.3031	0.3	5.8084
19	A	18-Jan-02	3	23.55	0.3653	0.35	7.0007
19	A	24-Jan-02	3	23.575	0.4259	0.37	8.1621
20	A	10-Jan-02	3	23.608	2.0988	11.14	40.2242
20	A	18-Jan-02	3	23.567	2.392	12.51	45.8433
20	A	23-Jan-02	3	23.575	2.0285	10.57	38.8756
21	A	10-Jan-02	3	23.625	0.6363	2.82	12.1953
21	A	18-Jan-02	3	23.583	0.7867	3.16	15.0772
21	A	23-Jan-02	3	23.583	0.7201	3.13	13.8014
22	A	10-Jan-02	4	23.625	1.3162	6.86	25.225
22	A	18-Jan-02	4	23.583	1.4772	7.54	28.3117
22	A	23-Jan-02	4	23.575	1.2145	6.18	23.2758
23	A	10-Jan-02	4	23.625	0.42	0.37	8.0496
23	A	18-Jan-02	4	23.558	0.3936	0.33	7.543
23	A	14-Jan-02	4	N/D	N/D	N/D	N/D
24	A	10-Jan-02	4	23.625	0.3953	0.35	7.575
24	A	18-Jan-02	4	23.6	0.104	0.6	1.9931
24	A	14-Jan-02	4	23.617	0.5512	2.04	10.5629
25	A	10-Jan-02	5	23.625	1.6966	8.55	32.5163
25	A	18-Jan-02	5	23.575	1.8585	9.59	35.6183
25	A	23-Jan-02	5	23.575	1.8736	9.71	35.9084
26	A	17-Jan-02	5	23.608	1.1803	5.35	22.6203
26	A	18-Jan-02	5	23.567	1.4194	6.64	27.2026
26	A	23-Jan-02	5	23.583	1.0733	4.83	20.5707
27	A	18-Jan-02	5	23.575	0.0518	0.3	0.9934
27	A	23-Jan-02	5	23.583	0.0671	0.39	1.2866
27	A	14-Jan-02	5	23.608	0.2466	0.25	4.7263
28	A	10-Jan-02	6	23.633	0.5162	0.48	9.8931
28	A	18-Jan-02	6	23.575	0.5862	0.58	11.2339
28	A	23-Jan-02	6	23.592	0.0595	0.35	1.14
29	A	10-Jan-02	6	23.617	2.5219	13.95	48.3327
29	A	18-Jan-02	6	23.558	2.7063	14.31	51.8659



Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (µS*min)	Height (µS)	Amount (ppm)
29	A	23-Jan-02	6	23.567	2.555	13.58	48.9673
30	A	10-Jan-02	6	23.617	2.5234	13.41	48.3606
30	A	18-Jan-02	6	23.55	2.6776	14.12	51.317
30	A	24-Jan-02	6	23.558	2.5741	14.17	49.3328
31	A	10-Jan-02	5	23.617	0.494	0.43	9.4679
31	A	18-Jan-02	5	23.567	0.4462	0.4	8.5522
31	A	14-Jan-02	5	23.608	0.2872	0.25	5.5037
32	A	17-Jan-02	5	23.608	0.627	1.9	12.0167
32	A	18-Jan-02	5	23.575	0.591	1.99	11.3263
32	A	23-Jan-02	5	23.583	0.683	1.98	13.0895
33	A	18-Jan-02	5	23.575	1.0649	5.05	20.4088
33	A	23-Jan-02	5	23.575	1.0825	5.19	20.7462
33	A	14-Jan-02	5	23.608	0.9313	4.49	17.8478
34	A	22-Jan-02	8	23.575	0.3408	0.3	6.532
34	A	10-Jan-02	8	23.608	0.2816	0.27	5.3977
34	A	24-Jan-02	8	23.583	0.3111	0.29	5.9628
35	A	22-Jan-02	8	23.567	0.3884	1.25	7.4434
35	A	10-Jan-02	8	23.633	0.5688	2.59	10.9012
35	A	24-Jan-02	8	23.583	0.3093	1.15	5.9279
36	A	17-Jan-02	8	23.6	0.5748	2.51	11.0157
36	A	22-Jan-02	8	23.558	1.0294	5.04	19.7292
36	A	24-Jan-02	8	23.583	0.811	3.92	15.5435
37	A	22-Jan-02	7	23.55	2.4406	12.66	46.7749
37	A	10-Jan-02	7	23.625	2.3236	12.28	44.5316
37	A	24-Jan-02	7	23.575	2.4329	12.74	46.627
38	A	22-Jan-02	7	23.567	0.0713	0.41	1.3674
38	A	10-Jan-02	7	23.642	0.4199	0.46	8.0484
38	A	24-Jan-02	7	23.583	0.068	0.39	1.3038
39	A	17-Jan-02	7	23.592	0.4107	0.36	7.8707
39	A	22-Jan-02	7	23.558	0.4466	0.38	8.559
39	A	24-Jan-02	7	23.583	0.359	0.32	6.8805
40	A	17-Jan-02	8	23.567	0.4054	0.33	7.7687
40	A	22-Jan-02	8	23.542	0.4369	0.35	8.3731
40	A	24-Jan-02	8	23.567	0.4126	0.33	7.9085
41	A	22-Jan-02	8	23.508	0.3937	0.32	7.5453
41	A	10-Jan-02	8	23.617	0.4218	0.34	8.0848
41	A	24-Jan-02	8	23.533	0.292	0.26	5.597
42	A	17-Jan-02	8	N/D	N/D	N/D	N/D
42	A	22-Jan-02	8	N/D	N/D	N/D	N/D
42	A	24-Jan-02	8	23.55	0.3611	0.3	6.9214
43	A	22-Jan-02	9	23.558	0.0591	0.35	1.1332
43	A	10-Jan-02	9	23.642	0.108	0.63	2.0706
43	A	14-Jan-02	9	23.617	0.1091	0.63	2.0905
44	A	22-Jan-02	9	23.55	0.4494	0.37	8.6129

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (µS*min)	Height (µS)	Amount (ppm)
44	A	10-Jan-02	9	23.633	0.4108	0.59	7.8733
44	A	14-Jan-02	9	23.6	0.4925	0.4	9.438
45	A	22-Jan-02	9	23.542	2.2379	10.92	42.889
45	A	10-Jan-02	9	23.625	2.9626	15.37	56.778
45	A	24-Jan-02	9	23.575	2.1479	10.1	41.1654
46	A	17-Jan-02	10	23.6	0.1437	0.83	2.7545
46	A	22-Jan-02	10	23.558	0.0808	0.47	1.5495
46	A	24-Jan-02	10	23.592	0.0552	0.32	1.0581
47	A	17-Jan-02	10	23.592	0.4385	0.44	8.403
47	A	22-Jan-02	10	23.558	0.4746	0.58	9.0963
47	A	24-Jan-02	10	23.592	0.4247	0.52	8.1392
48	A	22-Jan-02	10	23.55	1.893	9.02	36.2788
48	A	10-Jan-02	10	23.625	1.4938	7.35	28.6286
48	A	14-Jan-02	10	23.6	1.7599	8.92	33.7296
49	A	22-Jan-02	11	23.567	0.0721	0.42	1.3811
49	A	10-Jan-02	11	23.642	0.0813	0.48	1.5581
49	A	24-Jan-02	11	N/D	N/D	N/D	N/D
50	A	22-Jan-02	11	23.558	1.0006	4.48	19.1759
50	A	10-Jan-02	11	23.633	1.4049	6.68	26.9255
50	A	24-Jan-02	11	N/D	N/D	N/D	N/D
51	A	22-Jan-02	11	23.558	0.43	0.4	8.2402
51	A	10-Jan-02	11	23.633	0.4141	0.37	7.9368
51	A	24-Jan-02	11	N/D	N/D	N/D	N/D
52	A	17-Jan-02	12	23.6	0.3565	1.31	6.8332
52	A	22-Jan-02	12	23.558	0.3956	1.44	7.5824
52	A	24-Jan-02	12	N/D	N/D	N/D	N/D
53	A	17-Jan-02	12	23.592	0.8695	4.28	16.6637
53	A	22-Jan-02	12	23.55	0.9892	4.93	18.9584
53	A	24-Jan-02	12	N/D	N/D	N/D	N/D
54	A	22-Jan-02	12	23.542	0.4591	0.38	8.7987
54	A	10-Jan-02	12	23.6	0.3384	0.31	6.4851
54	A	24-Jan-02	12	N/D	N/D	N/D	N/D
55	A	22-Jan-02	13	23.558	0.6514	2.38	12.4833
55	A	10-Jan-02	13	23.642	0.8433	3.73	16.1624
55	A	24-Jan-02	13	N/D	N/D	N/D	N/D
56*	A	17-Jan-02	13	23.558	7.7845	39.93	149.192
56*	A	22-Jan-02	13	23.508	8.6791	44.42	166.3357
56	A	24-Jan-02	13	N/D	N/D	N/D	N/D
57	A	22-Jan-02	13	23.567	0.4397	1.31	8.4275
57	A	10-Jan-02	13	23.633	0.0736	0.43	1.4109
57	A	24-Jan-02	13	N/D	N/D	N/D	N/D
58	A	22-Jan-02	12	23.55	0.2688	0.24	5.1525
58	A	10-Jan-02	12	23.617	0.2469	0.22	4.7327
58	A	24-Jan-02	12	N/D	N/D	N/D	N/D

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
59	A	22-Jan-02	12	23.533	0.3891	0.32	7.4568
59	A	10-Jan-02	12	23.608	0.3752	0.31	7.1912
59	A	24-Jan-02	12	N/D	N/D	N/D	N/D
60	A	22-Jan-02	12	23.533	0.3801	0.3	7.2853
60	A	10-Jan-02	12	23.625	0.3978	0.33	7.6231
60	A	14-Jan-02	12	23.6	0.2905	0.26	5.5679
61	A	22-Jan-02	13	23.55	0.3834	0.31	7.3481
61	A	10-Jan-02	13	23.625	0.2907	0.31	5.5707
61	A	14-Jan-02	13	23.6	0.206	0.25	3.9483
62	A	22-Jan-02	13	23.533	0.3452	0.28	6.6159
62	A	10-Jan-02	13	23.658	0.0637	0.38	1.2212
62	A	24-Jan-02	13	N/D	N/D	N/D	N/D
63	A	22-Jan-02	13	23.55	2.0131	10.2	38.5805
63*	A	10-Jan-02	13	23.608	5.2865	27.15	101.3174
63	A	14-Jan-02	13	23.617	0.0589	0.34	1.1282
64	A	22-Jan-02	14	23.567	0.4704	1.61	9.016
64	A	10-Jan-02	14	23.642	0.3459	0.36	6.6296
64	A	24-Jan-02	14	N/D	N/D	N/D	N/D
65	A	17-Jan-02	14	23.592	1.1072	5.72	21.2195
65	A	22-Jan-02	14	23.55	1.3186	6.48	25.2703
65	A	24-Jan-02	14	N/D	N/D	N/D	N/D
66	A	17-Jan-02	14	23.608	0.0809	0.47	1.5509
66	A	23-Jan-02	14	23.558	0.4118	0.47	7.8924
66	A	24-Jan-02	14	N/D	N/D	N/D	N/D

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix AT: Sulfate, Strata B

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	B	25-Jan-02	1	23.558	1.7077	8.69	32.7291
1	B	17-Jan-02	1	23.583	1.5361	8.05	29.4395
1	B	15-Jan-02	1	23.592	1.3255	6.5	25.4037
2*	B	25-Jan-02	1	23.533	7.7587	38.66	148.6963
2*	B	13-Jan-02	1	23.583	7.1591	34.88	137.2055
2*	B	15-Jan-02	1	23.55	8.1647	40.54	156.4779
3	B	25-Jan-02	1	23.558	1.6466	8.35	31.5567
3	B	13-Jan-02	1	23.608	1.2278	5.84	23.5307
3	B	15-Jan-02	1	23.592	1.4058	6.86	26.9417
4	B	25-Jan-02	2	23.558	1.256	6.41	24.0713
4	B	13-Jan-02	2	23.608	1.2884	6.71	24.6928
4	B	15-Jan-02	2	23.592	1.477	7.62	28.3067
5	B	25-Jan-02	2	23.575	0.4288	0.56	8.218
5	B	17-Jan-02	2	23.6	0.4083	0.39	7.8251
5	B	15-Jan-02	2	23.6	0.1001	0.58	1.9179
6	B	25-Jan-02	2	23.575	0.487	1.44	9.3337
6	B	13-Jan-02	2	23.617	0.1896	1.09	3.6336
6	B	15-Jan-02	2	23.6	0.2017	1.16	3.8664
7	B	25-Jan-02	1	23.575	0.4915	1.74	9.4198
7	B	17-Jan-02	1	23.6	0.0812	0.47	1.5564
7	B	15-Jan-02	1	23.6	0.3546	0.46	6.7951
8	B	25-Jan-02	1	23.567	0.3657	0.35	7.0079
8	B	13-Jan-02	1	23.617	0.4567	0.51	8.7517
8	B	15-Jan-02	1	23.608	0.4055	0.43	7.7716
9	B	25-Jan-02	1	23.558	1.7992	9.46	34.4814
9	B	13-Jan-02	1	23.6	1.9955	10.49	38.244
9	B	15-Jan-02	1	23.592	2.174	11.55	41.6652
10	B	25-Jan-02	2	23.55	2.5544	14.09	48.9544
10	B	13-Jan-02	2	23.592	2.5668	14.24	49.1934
10	B	15-Jan-02	2	23.583	2.6992	14.91	51.7312
11	B	25-Jan-02	2	23.567	0.4025	0.48	7.7142
11	B	13-Jan-02	2	23.617	0.3733	0.52	7.1546
11	B	15-Jan-02	2	23.6	0.4026	0.48	7.7168
12	B	25-Jan-02	2	23.558	0.4466	0.37	8.5595
12	B	13-Jan-02	2	23.617	0.4333	0.42	8.3037
12	B	15-Jan-02	2	23.6	0.4608	0.42	8.8316
13	B	17-Jan-02	3	23.592	0.3636	0.36	6.9691
14	B	25-Jan-02	3	23.55	0.3461	0.31	6.6321
14	B	13-Jan-02	3	23.608	0.4736	0.45	9.0762
14	B	15-Jan-02	3	23.608	0.469	0.56	8.9886
15	B	25-Jan-02	3	23.575	0.4244	0.57	8.1329
15	B	13-Jan-02	3	23.6	0.4549	0.36	8.7184
15	B	15-Jan-02	3	23.6	0.467	0.47	8.95

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
16	B	25-Jan-02	4	23.575	0.4135	1.41	7.9247
16	B	13-Jan-02	4	23.617	0.5268	1.95	10.0964
16	B	15-Jan-02	4	23.6	0.7133	3.04	13.6707
17	B	25-Jan-02	4	23.542	0.392	0.32	7.5124
17	B	17-Jan-02	4	23.583	0.3621	0.3	6.9392
17	B	15-Jan-02	4	23.6	0.425	0.52	8.1457
18	B	25-Jan-02	4	23.558	0.3551	0.33	6.8054
18	B	17-Jan-02	4	23.583	0.4278	0.34	8.1995
18	B	15-Jan-02	4	23.6	0.4653	0.42	8.9178
19	B	25-Jan-02	3	23.525	0.4036	0.33	7.7358
19	B	17-Jan-02	3	23.583	0.4667	0.37	8.944
19	B	16-Jan-02	3	23.592	0.0728	0.42	1.3949
20	B	25-Jan-02	3	23.55	1.6515	8.3	31.6518
20	B	13-Jan-02	3	23.6	2.4185	12.81	46.3516
20	B	15-Jan-02	3	23.592	2.4008	12.5	46.0123
21	B	25-Jan-02	3	23.558	0.6615	2.56	12.6773
21	B	13-Jan-02	3	23.617	0.7218	3.19	13.8333
21	B	15-Jan-02	3	23.608	0.7245	3.23	13.8858
22	B	25-Jan-02	4	23.542	1.6397	8.35	31.4251
22	B	13-Jan-02	4	23.6	1.8603	9.76	35.6524
22	B	15-Jan-02	4	23.592	1.8365	9.43	35.197
23	B	25-Jan-02	4	23.558	0.3024	0.36	5.7951
23	B	13-Jan-02	4	23.017	0.0288	0.21	0.5518
23	B	15-Jan-02	4	23.6	0.3291	0.33	6.3078
24	B	25-Jan-02	4	23.558	0.342	0.3	6.5537
24	B	13-Jan-02	4	23.6	0.4028	0.34	7.7188
24	B	15-Jan-02	4	23.592	0.3557	0.31	6.8179
25	B	25-Jan-02	5	23.567	1.1466	5.25	21.9748
25	B	13-Jan-02	5	23.608	1.1228	4.98	21.5178
25	B	15-Jan-02	5	23.608	0.9773	4.09	18.7297
26	B	25-Jan-02	5	23.567	0.1108	0.64	2.1231
26	B	13-Jan-02	5	23.617	0.0548	0.32	1.0504
26	B	15-Jan-02	5	23.608	0.1785	1.03	3.4207
27	B	25-Jan-02	5	23.542	0.3678	0.34	7.0485
27	B	13-Jan-02	5	23.617	0.4725	0.4	9.0548
27	B	15-Jan-02	5	23.6	0.4854	0.43	9.3032
28	B	25-Jan-02	6	23.558	0.3695	0.44	7.0817
28	B	13-Jan-02	6	23.617	0.4337	0.6	8.3118
28	B	15-Jan-02	6	23.608	0.5051	1.57	9.68
29	B	25-Jan-02	6	23.55	1.5915	8.25	30.5003
29	B	13-Jan-02	6	23.608	1.7649	9.24	33.8239
29	B	15-Jan-02	6	23.592	1.8049	9.37	34.5904
30	B	25-Jan-02	6	23.567	0.1196	0.69	2.2922
30	B	13-Jan-02	6	23.608	0.6035	2.21	11.5668

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (µS*min)	Height (µS)	Amount (ppm)
30	B	15-Jan-02	6	23.608	0.5436	1.78	10.4191
31	B	25-Jan-02	5	23.558	0.4854	1.52	9.3036
31	B	13-Jan-02	5	23.608	1.0069	4.36	19.2982
31	B	15-Jan-02	5	23.6	1.1254	5.07	21.5693
32	B	13-Jan-02	5	23.625	0.4184	0.58	8.0195
32	B	15-Jan-02	5	23.617	0.4202	0.56	8.0527
32	B	16-Jan-02	5	23.583	0.7643	2.89	14.647
33	B	25-Jan-02	5	23.55	1.5629	7.85	29.9529
33	B	13-Jan-02	5	23.617	1.1684	5.83	22.393
33	B	15-Jan-02	5	23.592	1.6551	8.58	31.7207
34	B	16-Jan-02	8	23.558	0.3469	0.31	6.6485
34	B	26-Jan-02	8	23.567	0.3522	0.35	6.7491
34	B	13-Jan-02	8	23.625	0.3788	0.37	7.2595
35	B	16-Jan-02	8	23.6	0.2096	0.27	4.0175
35	B	26-Jan-02	8	23.567	0.1146	0.19	2.1972
35	B	13-Jan-02	8	23.625	0.0595	0.35	1.1397
36	B	16-Jan-02	8	23.558	0.2579	0.24	4.9423
36	B	26-Jan-02	8	23.55	0.2845	0.24	5.4519
36	B	13-Jan-02	8	23.608	0.3115	0.27	5.9703
37	B	26-Jan-02	7	23.567	0.7329	2.37	14.0469
37	B	13-Jan-02	7	23.625	0.5081	1.57	9.7382
37	B	23-Jan-02	7	23.575	0.6359	1.92	12.1875
38	B	16-Jan-02	7	23.592	0.4383	0.56	8.3998
38	B	26-Jan-02	7	23.567	0.0577	0.34	1.1053
38	B	13-Jan-02	7	23.625	0.057	0.33	1.0919
39	B	16-Jan-02	7	23.6	0.0716	0.42	1.3729
39	B	26-Jan-02	7	23.567	0.4585	0.56	8.7877
39	B	13-Jan-02	7	23.617	0.3601	0.41	6.9014
40	B	16-Jan-02	8	23.592	0.4497	0.44	8.6187
40	B	26-Jan-02	8	23.575	0.431	0.5	8.2595
40	B	13-Jan-02	8	23.617	0.4281	0.37	8.2043
41	B	16-Jan-02	8	N/D	N/D	N/D	N/D
41	B	26-Jan-02	8	23.533	0.3391	0.29	6.4996
41	B	13-Jan-02	8	23.608	0.3749	0.33	7.1842
42	B	16-Jan-02	8	23.592	0.3464	0.38	6.6389
42	B	26-Jan-02	8	23.558	0.3172	0.31	6.0792
42	B	13-Jan-02	8	23.625	0.3569	0.41	6.8394
43	B	16-Jan-02	9	23.592	0.506	0.55	9.6978
43	B	26-Jan-02	9	23.567	0.4619	0.5	8.8524
43	B	13-Jan-02	9	23.633	0.1963	1.13	3.7612
44	B	16-Jan-02	9	23.592	0.3791	0.38	7.2662
44	B	26-Jan-02	9	23.567	0.3884	0.39	7.4429
44	B	13-Jan-02	9	23.617	0.3347	0.4	6.4153
45	B	16-Jan-02	9	23.592	0.39	0.41	7.4753

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
45	B	26-Jan-02	9	23.575	0.0757	0.44	1.4499
45	B	13-Jan-02	9	23.625	0.4051	0.45	7.7634
46	B	16-Jan-02	10	N/D	N/D	N/D	N/D
46	B	26-Jan-02	10	23.533	0.4071	0.33	7.8013
46	B	13-Jan-02	10	23.583	0.4058	0.33	7.7769
47	B	16-Jan-02	10	23.558	0.4432	0.35	8.494
47	B	26-Jan-02	10	23.542	0.3732	0.31	7.1528
47	B	13-Jan-02	10	23.625	0.4458	0.4	8.5441
48	B	15-Jan-02	10	23.6	1.1609	5.62	22.2493
48	B	16-Jan-02	10	23.6	0.5603	1.43	10.7388
48	B	13-Jan-02	10	23.617	2.4148	12.75	46.2806
49	B	16-Jan-02	11	23.6	0.5196	1.53	9.9574
49	B	26-Jan-02	11	23.567	0.0994	0.57	1.9041
49	B	13-Jan-02	11	23.633	0.1221	0.71	2.3399
50	B	26-Jan-02	11	23.567	0.399	0.44	7.647
50	B	13-Jan-02	11	23.625	0.4127	0.43	7.9094
50	B	23-Jan-02	11	23.583	0.0604	0.35	1.1584
51	B	16-Jan-02	11	23.592	0.4	1.26	7.6652
51	B	26-Jan-02	11	23.567	0.1253	0.72	2.4013
51	B	13-Jan-02	11	23.633	0.3743	1.25	7.1731
52	B	16-Jan-02	12	23.592	0.1579	0.9	3.0254
52	B	26-Jan-02	12	23.567	0.705	2.91	13.5109
52	B	13-Jan-02	12	23.625	0.1466	0.84	2.8099
53	B	16-Jan-02	12	23.592	0.2859	0.46	5.4784
53	B	26-Jan-02	12	23.567	0.2125	0.22	4.0718
53	B	13-Jan-02	12	23.625	0.0645	0.38	1.2369
54	B	16-Jan-02	12	23.583	0.391	0.31	7.4933
54	B	26-Jan-02	12	23.558	0.3561	0.33	6.8243
54	B	13-Jan-02	12	23.608	0.3723	0.31	7.1356
55	B	16-Jan-02	13	23.592	0.5315	1.61	10.1869
55	B	26-Jan-02	13	23.567	0.6782	2	12.9971
55	B	13-Jan-02	13	23.625	0.6165	2.14	11.815
56	B	15-Jan-02	13	23.608	0.7352	3.21	14.0906
56	B	16-Jan-02	13	23.592	0.3434	0.34	6.5813
57	B	16-Jan-02	13	23.592	0.2982	0.38	5.7145
57	B	26-Jan-02	13	23.567	0.3312	0.45	6.3469
57	B	13-Jan-02	13	23.617	0.2911	0.28	5.5791
58	B	16-Jan-02	12	23.592	0.7415	3.47	14.2113
58	B	26-Jan-02	12	23.567	0.5662	2.21	10.8509
58	B	13-Jan-02	12	23.617	0.7994	3.86	15.3205
59	B	16-Jan-02	12	23.583	0.3847	0.37	7.3731
59	B	26-Jan-02	12	23.567	0.4294	0.53	8.2287
59	B	13-Jan-02	12	23.633	0.1177	0.68	2.2552
60	B	16-Jan-02	12	23.567	0.4562	0.37	8.7439

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
60	B	26-Jan-02	12	23.558	0.3788	0.35	7.2589
60	B	13-Jan-02	12	23.617	0.4564	0.39	8.747
61	B	16-Jan-02	13	23.592	0.5054	0.6	9.6853
61	B	26-Jan-02	13	23.558	0.377	0.32	7.2245
61	B	13-Jan-02	13	23.625	0.3432	0.34	6.5767
62	B	16-Jan-02	13	23.583	0.4297	0.35	8.2359
62	B	26-Jan-02	13	23.558	0.3639	0.3	6.9738
62	B	13-Jan-02	13	23.617	0.4065	0.33	7.7898
63	B	16-Jan-02	13	23.575	0.4115	0.34	7.8855
63	B	26-Jan-02	13	23.567	0.4187	0.44	8.0252
63	B	13-Jan-02	13	23.608	0.3697	0.32	7.0847
64	B	16-Jan-02	14	23.6	0.066	0.38	1.2646
64	B	26-Jan-02	14	23.575	0.1178	0.67	2.2576
64	B	13-Jan-02	14	23.617	0.335	0.38	6.4205
65	B	16-Jan-02	14	23.592	0.2565	0.27	4.9163
65	B	26-Jan-02	14	23.567	0.1796	0.25	3.4414
65	B	13-Jan-02	14	23.625	0.2205	0.3	4.2263
66	B	16-Jan-02	14	23.592	0.4077	0.44	7.814
66	B	26-Jan-02	14	23.575	0.3453	0.32	6.6175
66	B	13-Jan-02	14	23.625	0.4149	0.41	7.9512

\*—JMP 4.0 Outlier

N/D—Not Detected



### Appendix AU: Sulfate, Strata C

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
1	C	16-Jan-02	1	23.567	2.5817	14.31	49.4779
1	C	17-Jan-02	1	23.567	2.8056	14.98	53.7691
1	C	26-Jan-02	1	23.533	2.5972	14.3	49.7754
2	C	16-Jan-02	1	23.567	2.7028	14.47	51.7994
2	C	17-Jan-02	1	23.567	2.6904	14.49	51.5626
2	C	26-Jan-02	1	23.525	2.6429	14.05	50.6518
3	C	16-Jan-02	1	23.567	2.6885	14.3	51.5252
3	C	17-Jan-02	1	23.567	2.7451	14.98	52.6107
3	C	26-Jan-02	1	23.525	2.7144	14.44	52.0226
4	C	16-Jan-02	2	23.558	2.7582	14.93	52.862
4	C	17-Jan-02	2	23.567	2.6895	14.35	51.5443
4	C	26-Jan-02	2	23.525	2.7159	14.52	52.051
5	C	16-Jan-02	2	23.567	2.7162	14.55	52.0562
5	C	17-Jan-02	2	23.567	2.8058	14.93	53.7734
5	C	26-Jan-02	2	23.533	2.7037	14.33	51.8163
7	C	16-Jan-02	1	23.558	2.6171	14.46	50.1575
7	C	26-Jan-02	1	23.525	2.5042	13.79	47.9938
7	C	22-Jan-02	1	23.542	2.5656	14.16	49.1701
8	C	26-Jan-02	1	23.525	2.6903	14.37	51.5591
8	C	23-Jan-02	1	23.567	2.5844	14.23	49.5301
8	C	22-Jan-02	1	23.542	2.594	14.33	49.7149
9	C	16-Jan-02	1	23.558	2.8006	15.45	53.6737
9	C	26-Jan-02	1	23.525	2.5589	14.07	49.0416
9	C	22-Jan-02	1	23.542	2.6226	14.45	50.2614
10	C	16-Jan-02	2	23.567	2.6536	14.65	50.8558
10	C	26-Jan-02	2	23.525	2.5871	14.24	49.5812
10	C	6-Jan-02	2	23.592	2.5747	13.84	49.3438
11	C	16-Jan-02	2	23.567	2.6971	14.37	51.6903
11	C	26-Jan-02	2	23.525	2.658	14.2	50.9411
11	C	6-Jan-02	2	23.633	2.7069	14.71	51.8786
12	C	16-Jan-02	2	23.567	2.6781	14.15	51.3257
12	C	26-Jan-02	2	23.525	2.6468	14.03	50.7268
12	C	23-Jan-02	2	23.558	2.7212	14.36	52.1522
13	C	16-Jan-02	3	23.567	2.7333	14.68	52.3842
13	C	10-Jan-02	3	23.558	2.6035	14.2	49.8959
13	C	26-Jan-02	3	23.525	2.7578	14.56	52.8535
14	C	10-Jan-02	3	23.592	2.5445	14.14	48.7658
14	C	26-Jan-02	3	23.517	2.5749	14.15	49.3485
14	C	23-Jan-02	3	23.55	2.6161	14.42	50.1385
15	C	10-Jan-02	3	23.608	2.6014	14.42	49.8568
15	C	26-Jan-02	3	23.525	2.4538	13.53	47.0267
15	C	23-Jan-02	3	23.558	2.6322	14.48	50.4473
16	C	10-Jan-02	4	23.608	2.5464	14.15	48.8025

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
16	C	26-Jan-02	4	23.525	2.5547	14.07	48.961
16	C	6-Jan-02	4	23.65	2.5229	13.72	48.3512
17	C	10-Jan-02	4	23.625	2.5205	13.97	48.3056
17	C	26-Jan-02	4	23.525	2.5987	13.89	49.8038
17	C	23-Jan-02	4	23.567	2.607	14.34	49.9633
18	C	10-Jan-02	4	23.617	2.5638	13.96	49.1355
18	C	26-Jan-02	4	23.533	2.59	14.24	49.6378
18	C	23-Jan-02	4	23.558	2.6471	14.56	50.7323
19	C	16-Jan-02	3	23.567	2.6742	14.73	51.2514
19	C	10-Jan-02	3	23.617	2.5035	13.36	47.9803
20	C	16-Jan-02	3	23.558	2.6118	14.42	50.0557
20	C	10-Jan-02	3	23.608	2.6822	14.86	51.4045
20	C	26-Jan-02	3	23.567	2.11	11.38	40.4376
21	C	10-Jan-02	3	23.608	2.6129	14.51	50.0761
21*	C	26-Jan-02	3	23.558	0.0185	0.06	0.3538
21	C	6-Jan-02	3	23.65	2.582	14.09	49.4833
22	C	5-Jan-02	4	23.517	2.4706	13.75	47.3499
22	C	10-Jan-02	4	23.592	2.5965	14.42	49.7624
22	C	6-Jan-02	4	23.658	2.6487	14.71	50.7619
23	C	5-Jan-02	4	23.592	2.568	14.04	49.2155
23	C	10-Jan-02	4	23.6	2.6371	14.64	50.5411
23	C	6-Jan-02	4	23.658	2.6168	14.24	50.1514
24	C	5-Jan-02	4	23.617	2.6136	14.26	50.0889
24	C	10-Jan-02	4	23.6	2.5751	14.31	49.3527
24	C	6-Jan-02	4	23.658	2.4719	13.76	47.3741
25	C	5-Jan-02	5	23.633	2.638	14.48	50.5578
25	C	10-Jan-02	5	23.6	2.6936	14.69	51.6231
25*	C	28-Jan-02	5	23.558	1.258	6.96	24.1101
26	C	10-Jan-02	5	23.6	2.5638	14.24	49.1362
26	C	28-Jan-02	5	23.55	2.5529	14.07	48.9263
26	C	23-Jan-02	5	23.558	2.6617	14.64	51.0109
27	C	10-Jan-02	5	23.6	2.64	14.64	50.5953
27	C	28-Jan-02	5	23.55	2.6489	14.31	50.7673
27	C	23-Jan-02	5	23.558	2.7751	14.84	53.1845
28	C	5-Jan-02	6	23.633	2.6828	14.62	51.4162
28	C	10-Jan-02	6	23.6	2.6006	14.43	49.8406
28	C	6-Jan-02	6	23.658	2.5881	14.1	49.6018
29	C	5-Jan-02	6	23.65	1.8658	10.3	35.7585
29*	C	10-Jan-02	6	23.617	1.4995	7.68	28.7381
29*	C	6-Jan-02	6	23.675	0.6536	2.9	12.5259
30	C	5-Jan-02	6	23.642	2.3702	13.21	45.4255
30	C	10-Jan-02	6	23.6	2.5975	14.41	49.7804
30	C	6-Jan-02	6	23.658	2.8902	16.02	55.3918
31	C	5-Jan-02	5	23.642	2.6634	14.42	51.0434

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
31	C	10-Jan-02	5	23.6	2.6371	14.62	50.5406
31	C	28-Jan-02	5	23.558	2.6498	14.55	50.7844
32	C	10-Jan-02	5	23.608	2.6624	14.54	51.0258
32	C	28-Jan-02	5	23.55	2.5605	14.1	49.0728
32	C	23-Jan-02	5	23.567	2.621	14.41	50.2318
33	C	10-Jan-02	5	23.6	2.5786	14.31	49.42
33	C	28-Jan-02	5	23.542	2.5124	13.83	48.1499
33	C	23-Jan-02	5	23.567	2.6035	14.31	49.8968
34	C	5-Jan-02	8	23.65	2.608	14.21	49.9822
34	C	10-Jan-02	8	23.6	2.6614	14.51	51.0062
34	C	6-Jan-02	8	23.667	2.5182	13.99	48.2622
35	C	5-Jan-02	8	23.65	2.7029	14.7	51.8016
35	C	10-Jan-02	8	23.6	2.5983	14.42	49.7975
35	C	6-Jan-02	8	23.658	2.6227	14.24	50.2638
36	C	5-Jan-02	8	23.658	2.4901	13.86	47.7233
36	C	10-Jan-02	8	23.608	2.605	14.44	49.9247
36	C	6-Jan-02	8	23.658	2.5973	14.41	49.7767
37	C	5-Jan-02	7	23.65	2.4631	13.1	47.2051
37	C	10-Jan-02	7	23.6	2.4626	13.11	47.195
37*	C	28-Jan-02	7	23.55	0.013	0.03	0.2496
37	C	6-Jan-02	7	23.667	2.6157	13.96	50.1293
38	C	10-Jan-02	7	23.6	2.639	14.63	50.5776
38	C	28-Jan-02	7	23.542	2.6367	14.24	50.5325
38	C	6-Jan-02	7	23.667	2.8429	15.42	54.4838
39	C	10-Jan-02	7	23.6	2.7399	15.16	52.5097
39	C	28-Jan-02	7	23.55	2.5843	14.23	49.5288
39	C	23-Jan-02	7	23.558	2.6141	14.4	50.1002
40	C	10-Jan-02	8	23.6	2.7647	14.84	52.9857
40	C	28-Jan-02	8	23.55	2.5322	13.94	48.5292
40	C	23-Jan-02	8	23.567	2.6972	14.43	51.6915
41	C	10-Jan-02	8	23.6	2.6984	14.95	51.7151
41	C	28-Jan-02	8	23.55	2.5754	14.19	49.3572
41	C	6-Jan-02	8	23.667	2.692	14.8	51.5932
42	C	10-Jan-02	8	23.6	2.6734	14.81	51.2369
42	C	28-Jan-02	8	23.55	2.5013	13.77	47.9368
42	C	23-Jan-02	8	23.567	2.6197	14.42	50.2072
43	C	10-Jan-02	9	23.592	2.7367	14.9	52.4492
43	C	28-Jan-02	9	23.55	2.6692	14.12	51.1545
43	C	6-Jan-02	9	23.658	3.0199	16.25	57.8768
44	C	10-Jan-02	9	23.6	2.8211	15.61	54.0658
44	C	28-Jan-02	9	23.55	2.5351	13.95	48.5858
44	C	23-Jan-02	9	23.558	2.6238	14.46	50.2853
45	C	10-Jan-02	9	23.6	2.6695	14.76	51.1606
45	C	28-Jan-02	9	23.55	2.607	14.34	49.9636

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (µS*min)	Height (µS)	Amount (ppm)
45	C	23-Jan-02	9	23.558	2.6463	14.56	50.7166
46	C	28-Jan-02	10	23.542	2.5315	13.95	48.5168
46	C	10-Jan-02	10	23.617	2.6232	14.54	50.2742
46	C	23-Jan-02	10	23.558	2.563	14.11	49.1193
47	C	28-Jan-02	10	23.55	2.5866	14.23	49.5715
47	C	10-Jan-02	10	23.617	2.6763	14.56	51.2923
47	C	23-Jan-02	10	23.558	2.6192	14.44	50.1975
48	C	28-Jan-02	10	23.55	2.4541	13.52	47.0321
48	C	10-Jan-02	10	23.608	2.6571	14.47	50.9231
48	C	6-Jan-02	10	23.667	2.6256	14.55	50.3205
49	C	28-Jan-02	11	23.542	2.6171	13.85	50.1564
49	C	10-Jan-02	11	23.617	2.7353	14.87	52.4215
49	C	6-Jan-02	11	23.667	2.5738	13.97	49.3266
50	C	28-Jan-02	11	23.542	2.5623	14.09	49.1063
50	C	10-Jan-02	11	23.6	2.6685	14.77	51.1427
50	C	6-Jan-02	11	23.667	2.5629	14.19	49.1187
51	C	28-Jan-02	11	23.55	2.642	14.53	50.6345
51	C	10-Jan-02	11	23.608	2.7433	15.17	52.575
51	C	6-Jan-02	11	23.675	2.5937	14.11	49.7079
52	C	28-Jan-02	12	23.542	2.5108	13.81	48.1188
52	C	10-Jan-02	12	23.608	2.7096	14.99	51.9291
52	C	23-Jan-02	12	23.558	2.6658	14.67	51.0898
53	C	28-Jan-02	12	23.542	2.6639	14.62	51.0536
53	C	10-Jan-02	12	23.608	2.7231	15.03	52.1886
53	C	23-Jan-02	12	23.558	2.6846	14.78	51.4511
54	C	28-Jan-02	12	23.55	2.5746	14.16	49.342
54	C	10-Jan-02	12	23.608	2.7058	14.97	51.8563
54	C	23-Jan-02	12	23.558	2.6101	14.39	50.0233
55	C	28-Jan-02	13	23.55	2.6032	13.95	49.8903
55	C	10-Jan-02	13	23.617	2.5992	14.39	49.8131
55	C	23-Jan-02	13	23.558	2.7082	14.46	51.9025
56	C	28-Jan-02	13	23.55	2.4506	13.48	46.9656
56	C	10-Jan-02	13	23.608	2.6158	14.49	50.1315
56	C	23-Jan-02	13	23.558	2.6422	14.53	50.6387
57	C	28-Jan-02	13	23.542	2.5634	14.1	49.1277
57	C	10-Jan-02	13	23.617	2.6252	14.54	50.3117
57	C	23-Jan-02	13	23.558	2.6534	14.58	50.8521
58	C	28-Jan-02	12	23.55	2.4905	13.68	47.7311
58	C	10-Jan-02	12	23.608	2.6519	14.64	50.8248
58	C	23-Jan-02	12	23.558	2.5794	14.18	49.4343
59	C	28-Jan-02	12	23.55	2.5166	13.84	48.2304
59	C	10-Jan-02	12	23.608	2.6809	14.82	51.3796
59	C	23-Jan-02	12	23.558	2.7778	14.77	53.2364
60	C	28-Jan-02	12	23.55	2.5786	14.19	49.4192

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
60	C	10-Jan-02	12	23.608	2.646	14.64	50.7108
60	C	6-Jan-02	12	23.658	2.9846	16.21	57.2004
61	C	28-Jan-02	13	23.542	2.4455	13.47	46.869
61	C	10-Jan-02	13	23.617	2.7059	14.49	51.8581
61	C	23-Jan-02	13	23.558	2.605	14.33	49.9252
62	C	28-Jan-02	13	23.55	2.5938	14.27	49.7103
62	C	10-Jan-02	13	23.608	2.5918	14.35	49.6716
62	C	23-Jan-02	13	23.558	2.6325	14.46	50.4523
63	C	28-Jan-02	13	23.542	2.4232	13.32	46.4403
63	C	10-Jan-02	13	23.608	2.5858	14.31	49.5578
63	C	23-Jan-02	13	23.558	2.6298	14.47	50.4001
64	C	28-Jan-02	14	23.55	2.4467	13.45	46.8912
64	C	10-Jan-02	14	23.617	2.762	15.03	52.9347
64	C	23-Jan-02	14	23.567	2.6183	14.4	50.1794
65	C	28-Jan-02	14	23.55	2.5349	13.95	48.5806
65	C	10-Jan-02	14	23.608	2.6566	14.69	50.9143
65	C	23-Jan-02	14	23.558	2.6788	14.72	51.3386
66	C	28-Jan-02	14	23.55	2.5747	13.6	49.3442
66	C	10-Jan-02	14	23.617	2.6441	14.63	50.6751
66	C	23-Jan-02	14	23.575	2.6457	14.53	50.7042

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix AV: Sulfate, Field Blanks, Influent and Effluent

Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
Blank	BLANK	10-Jan-02	B	23.567	0.0311	0.05	0.5955
Blank	BLANK	26-Jan-02	B	23.567	0.0096	0.04	0.1843
Blank	BLANK	28-Jan-02	B	23.558	0.0443	0.06	0.8497
Influent	INFLUENT	5-Jan-02	I	23.65	2.6359	14.36	50.5173
Influent	INFLUENT	10-Jan-02	I	23.6	2.6343	14.6	50.4872
Influent	INFLUENT	6-Jan-02	I	23.667	2.6706	14.5	51.1821
Effluent	EFFLUENT	5-Jan-02	E	23.658	2.4941	13.62	47.7992
Effluent	EFFLUENT	10-Jan-02	E	23.608	2.4566	13.41	47.08
Effluent	EFFLUENT	6-Jan-02	E	23.667	2.7629	14.89	52.9507

\*—JMP 4.0 Outlier

N/D—Not Detected

### Appendix AW: Excluded Outliers for Statistical Analysis

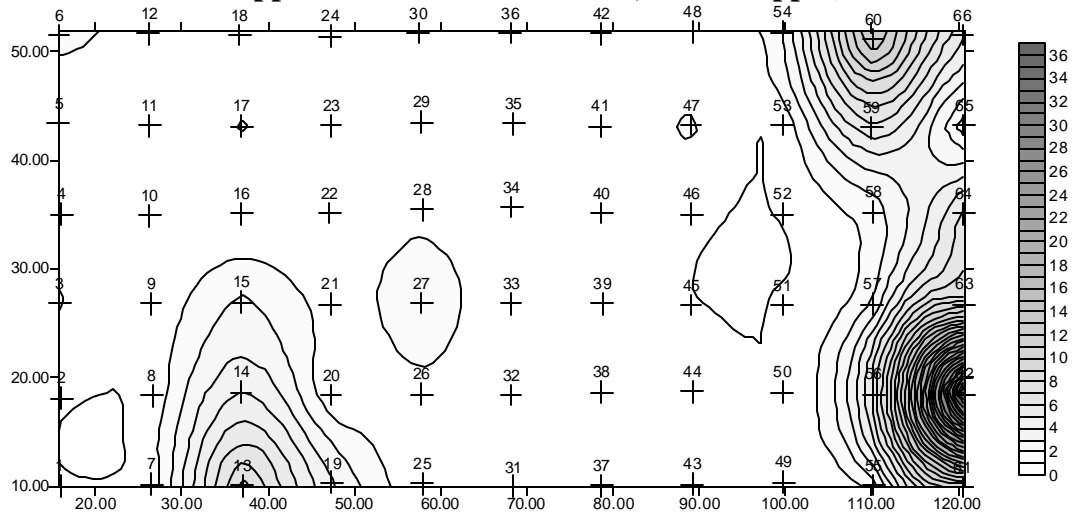
Analyte	Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S} \cdot \text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
<b>Acetate</b>								
	63	A	14-Jan-02	13	8.575	1.0334	3.23	26.7688
	49	B	16-Jan-02	11	8.458	0.1536	0.51	4.0134
	58	C	10-Jan-02	12	8.617	0.004	0.02	0.104
<b>Butyrate</b>								
	11	A	10-Jan-02	2	12.042	0.0325	0.06	2.3572
	28	C	10-Jan-02	6	11.792	0.0239	0.05	0.7377
	58	C	10-Jan-02	12	11.708	0.0246	0.04	0.757
<b>Chloride</b>								
	63	A	10-Jan-02	13	15.558	14.312	96.2	209.9321
	21	C	26-Jan-02	3	15.467	0.0204	0.16	0.2991
	25	C	28-Jan-02	5	15.475	3.0228	22.39	44.3396
	37	C	28-Jan-02	7	15.433	0.0043	0.03	0.0629
<b>Fluoride</b>								
	10	A	10-Jan-02	2	7.567	0.0026	0.01	0.0218
	11	A	10-Jan-02	2	7.758	0.0016	0.01	0.0135
	18	A	14-Jan-02	4	7.517	0.006	0.02	0.051
	26	A	17-Jan-02	5	7.8	0.0008	0	0.0069
	40	A	24-Jan-02	8	7.8	0.0016	0.01	0.0134
	41	A	24-Jan-02	8	7.8	0.0016	0.01	0.0135
	48	B	13-Jan-02	10	7.492	0.0407	0.19	0.3457
	10	C	06-Jan-02	2	7.575	0	0	0.0001
	11	C	06-Jan-02	2	7.775	0.0005	0	0.0042
	13	C	10-Jan-02	3	7.475	0.0022	0.01	0.0185
	14	C	10-Jan-02	3	7.792	0.0021	0.01	0.0175
	21	C	26-Jan-02	3	7.533	0.0002	0	0.0018
	22	C	05-Jan-02	4	7.683	0	0	0.0003
	23	C	05-Jan-02	4	7.5	0.0012	0.01	0.0106
	24	C	05-Jan-02	4	7.775	0.0032	0.02	0.0272
	37	C	28-Jan-02	7	7.458	0.0001	0	0.0009
<b>Formate</b>								
	60	A	14-Jan-02	12	11.217	0.0288	0.14	0.5952
	66	A	17-Jan-02	14	11.217	0.0499	0.27	1.0306
	29	C	06-Jan-02	6	11.317	0.0185	0.06	0.3487
	33	C	10-Jan-02	5	11.3	0.0149	0.04	0.2808

Analyte	Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area (μS*min)	Height (μS)	Amount (ppm)
<b>Lactate</b>								
	20	A	23-Jan-02	3	7.95	0.034	0.14	0.4192
	25	A	18-Jan-02	5	7.933	0.0221	0.09	0.2722
	28	A	23-Jan-02	6	7.825	0.0243	0.08	0.2986
	34	A	22-Jan-02	8	8.025	0.0243	0.09	0.2997
	63	A	14-Jan-02	13	7.867	0.0715	0.26	0.8802
	4	B	13-Jan-02	2	8.017	0.0204	0.08	1.1661
	11	B	13-Jan-02	2	8.133	0.0173	0.79	0.9913
	12	B	13-Jan-02	2	7.925	0.0135	0.04	0.7693
	25	B	13-Jan-02	5	7.95	0.0122	0.04	0.6974
	39	B	16-Jan-02	7	7.908	0.015	0.04	0.8588
	62	C	10-Jan-02	13	8.042	0.0354	0.15	2.0243
	66	C	28-Jan-02	14	7.925	0.0235	0.1	1.3447
<b>Nitrate</b>								
	4	A	17-Jan-02	2	21.275	0.005	0.03	0.0282
	6	A	17-Jan-02	2	21.175	0.0002	0	0.0011
	25	A	10-Jan-02	5	21.242	0.0003	0	0.0018
	48	A	10-Jan-02	10	21.275	0.0017	0.03	0.0095
	61	A	14-Jan-02	13	21.158	0.0004	0.01	0.0022
	63	A	22-Jan-02	13	21.158	0.0002	0	0.0009
	63	A	10-Jan-02	13	21.233	0.0042	0.03	0.0235
	66	A	17-Jan-02	14	21.225	0.0042	0.03	0.0233
	3	B	13-Jan-02	1	21.267	0.0061	0.05	0.0344
	8	B	13-Jan-02	1	21.242	0	0	0.0001
	23	B	15-Jan-02	4	21.217	0.0052	0.04	0.0291
	32	B	15-Jan-02	5	21.25	0.0023	0.04	0.0126
	36	B	16-Jan-02	8	21.258	0.0041	0.04	0.0227
	36	B	13-Jan-02	8	21.258	0.006	0.05	0.0334
	37	B	26-Jan-02	7	21.192	0.0022	0.04	0.0126
	53	B	16-Jan-02	12	21.275	0.0062	0.04	0.0346
	57	B	16-Jan-02	13	21.25	0.0021	0.03	0.0116
	65	B	16-Jan-02	14	21.208	0.0066	0.03	0.037
	25	C	05-Jan-02	5	21.125	0.0005	0.01	0.0029
	31	C	05-Jan-02	5	21.167	0.0034	0.03	0.0189

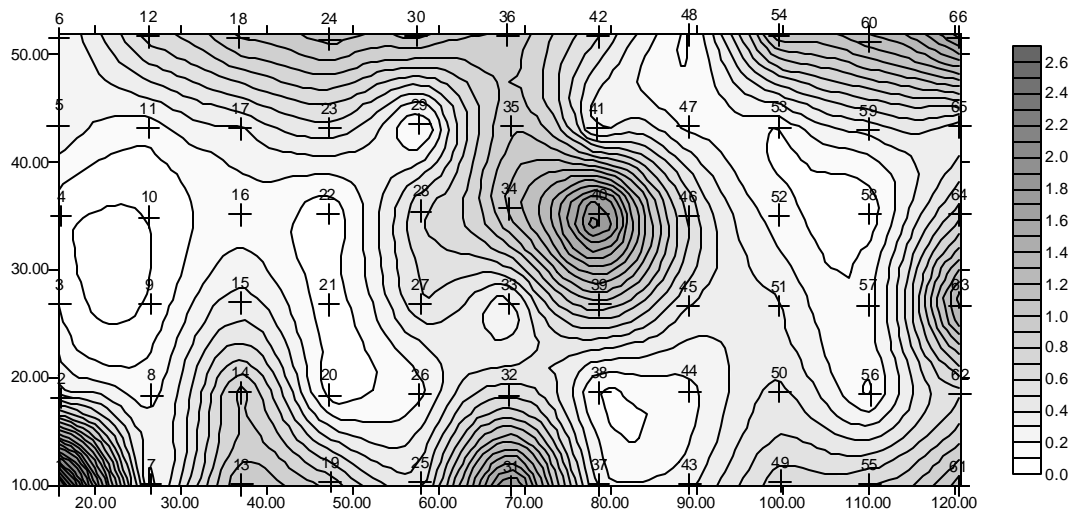


Analyte	Piezometer	Strata	Date Taken	Plot	Retention Time (min)	Area ( $\mu\text{S}\cdot\text{min}$ )	Height ( $\mu\text{S}$ )	Amount (ppm)
<b>Nitrite</b>								
	20	A	10-Jan-02	3	16.817	0.0036	0.02	0.0214
	25	A	10-Jan-02	5	16.817	0.0038	0.01	0.0229
	36	A	24-Jan-02	8	16.742	0.0052	0.04	0.031
	1	B	25-Jan-02	1	16.767	0.0122	0.08	0.0732
	31	B	13-Jan-02	5	16.783	0.0087	0.06	0.0522
	45	B	26-Jan-02	9	16.742	0.0162	0.11	0.0966
	2	C	16-Jan-02	1	16.792	0.0053	0.04	0.0315
	9	C	16-Jan-02	1	16.775	0.0064	0.04	0.038
	11	C	16-Jan-02	2	16.775	0.0069	0.05	0.041
	12	C	16-Jan-02	2	16.775	0.0059	0.04	0.0352
	13	C	16-Jan-02	3	16.783	0.0078	0.05	0.0464
<b>Propionate</b>								
	13	A	17-Jan-02	3	9.933	0.016	0.05	0.6228
	47	A	22-Jan-02	10	9.908	0.02	0.06	0.7816
	62	A	22-Jan-02	13	9.933	0.0162	0.05	0.6332
	62	A	10-Jan-02	13	9.875	0.0194	0.06	0.7549
	63	A	14-Jan-02	13	9.95	0.0132	0.04	0.5158
<b>Sulfate</b>								
	21	C	26-Jan-02	3	23.558	0.0185	0.06	0.3538
	25	C	28-Jan-02	5	23.558	1.258	6.96	24.1101
	29	C	06-Jan-02	6	23.675	0.6536	2.9	12.5259
	37	C	28-Jan-02	7	23.55	0.013	0.03	0.2496

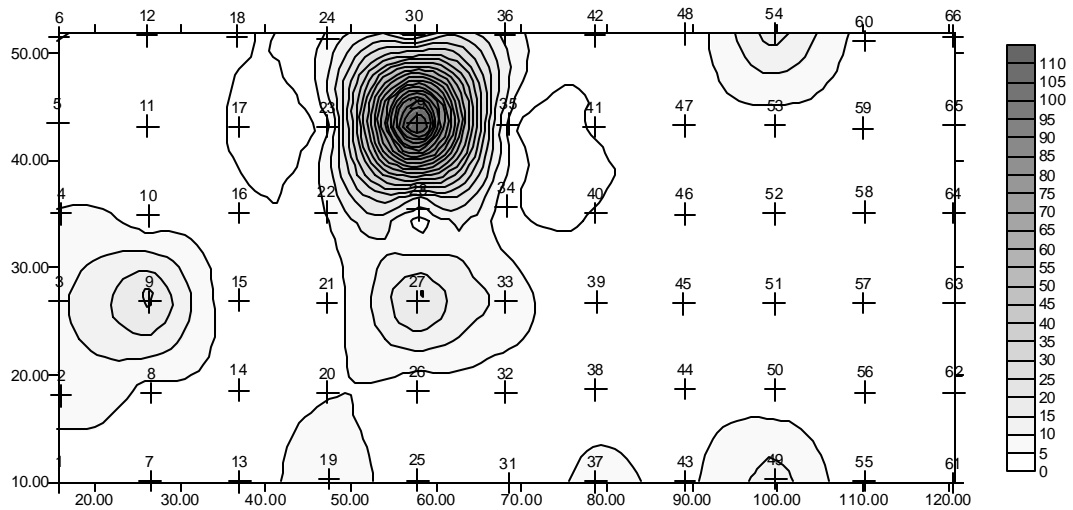
## Appendix AX: Contour Plots, Acetate (ppm)



**Strata A**

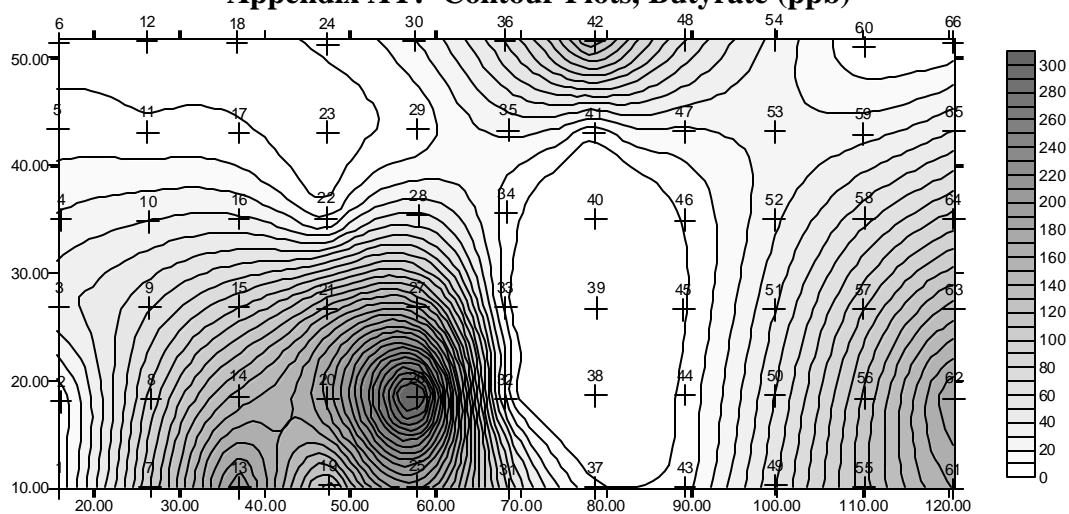


**Strata B**

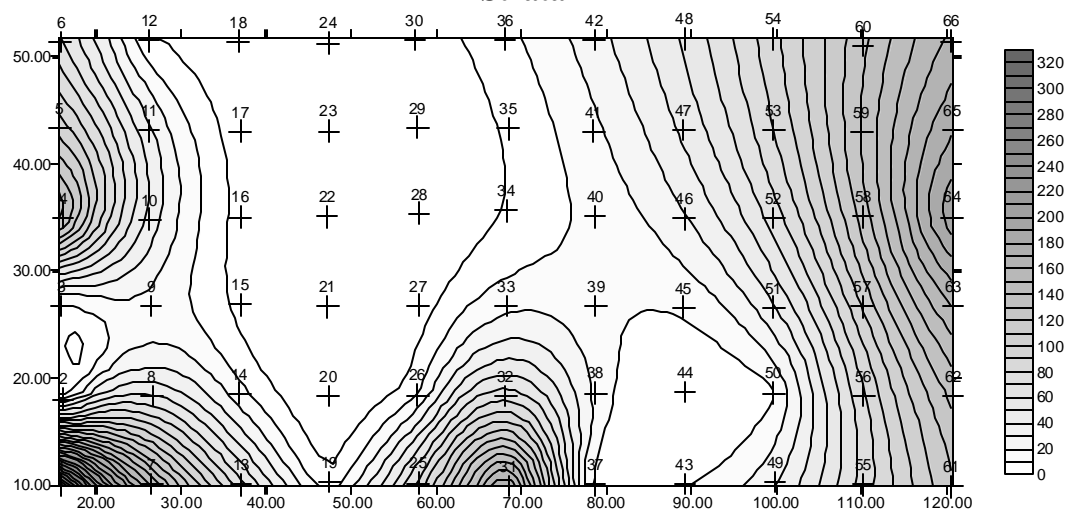


**Strata C**

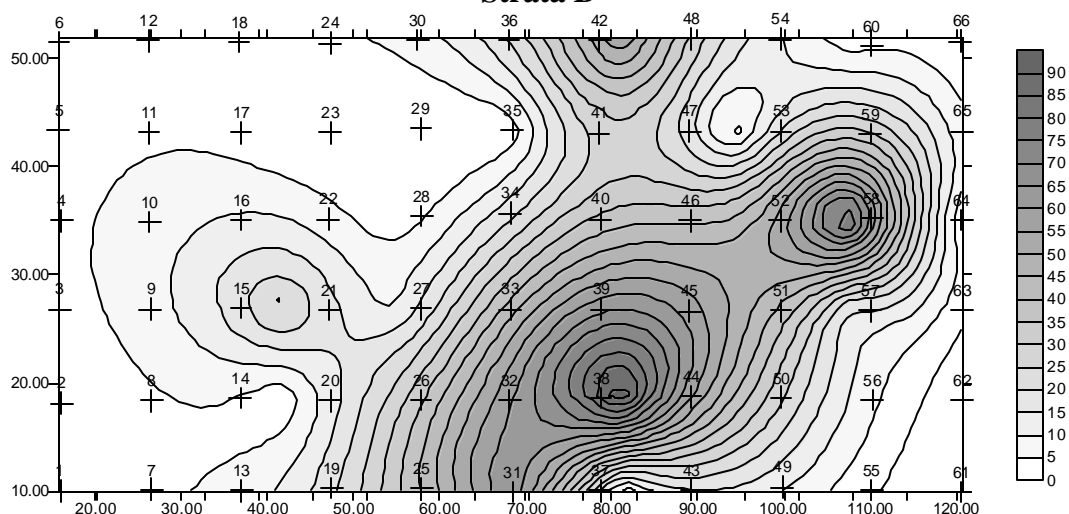
# **Appendix AY: Contour Plots, Butyrate (ppb)**



**Strata A**

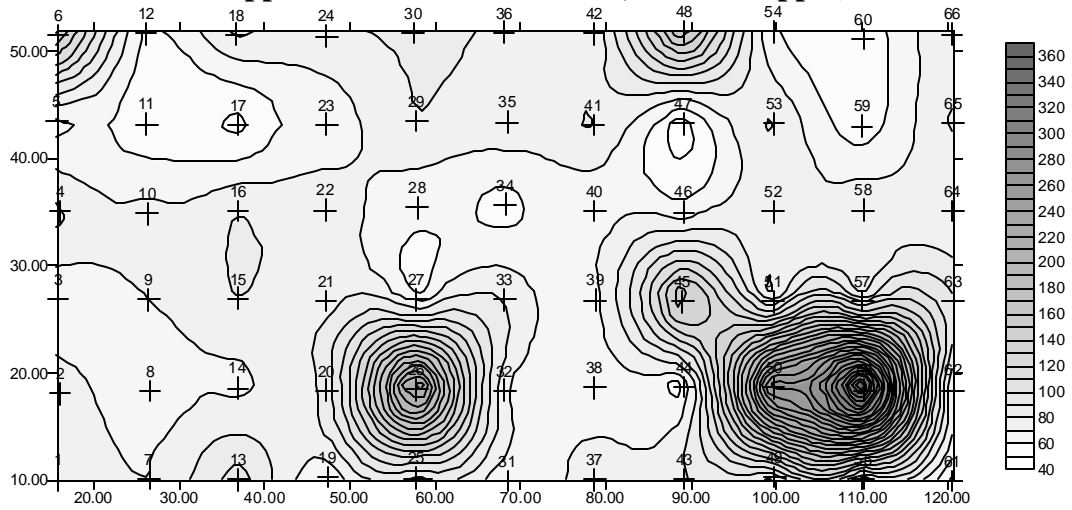


**Strata B**

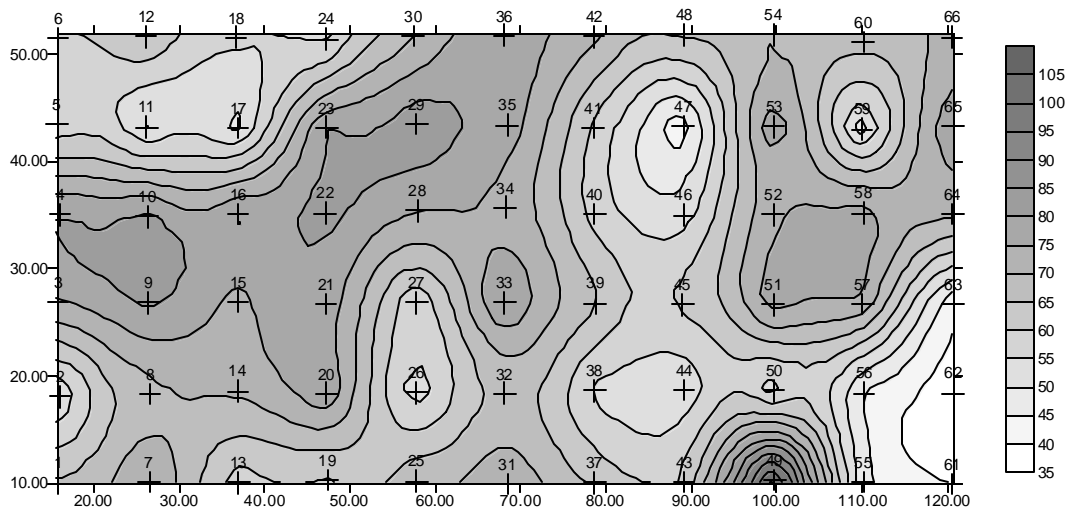


**Strata C**

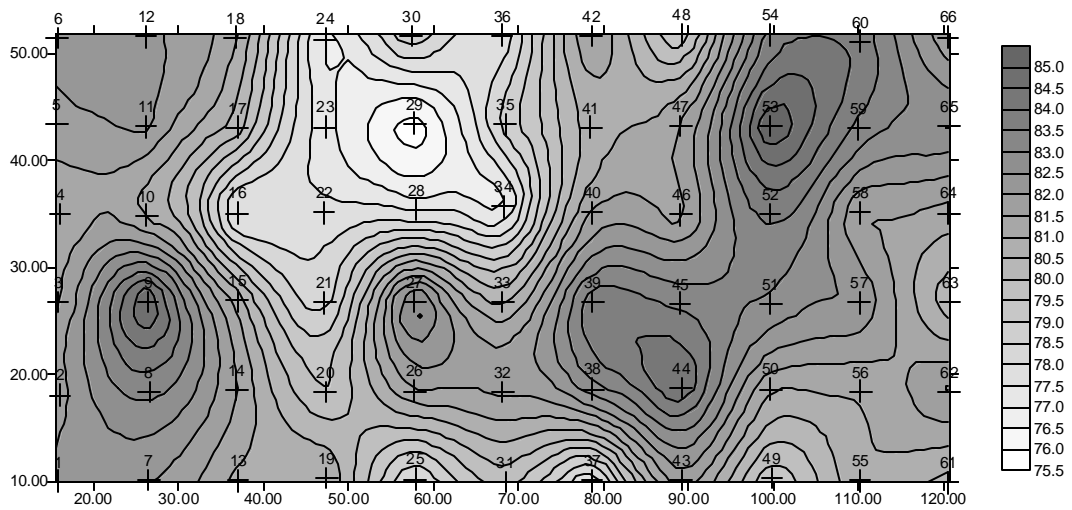
## Appendix AZ: Contour Plots, Chloride (ppm)



**Strata A**

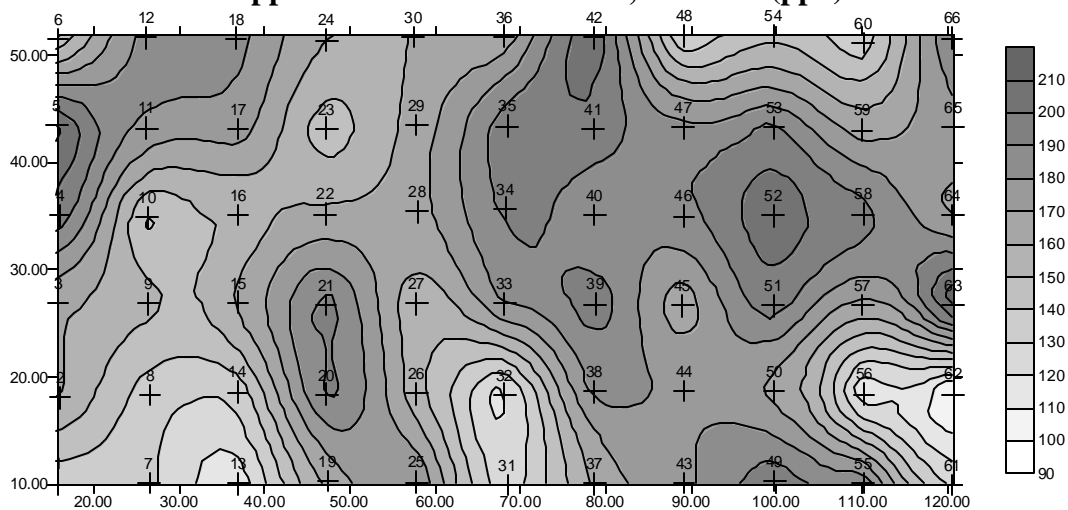


**Strata B**

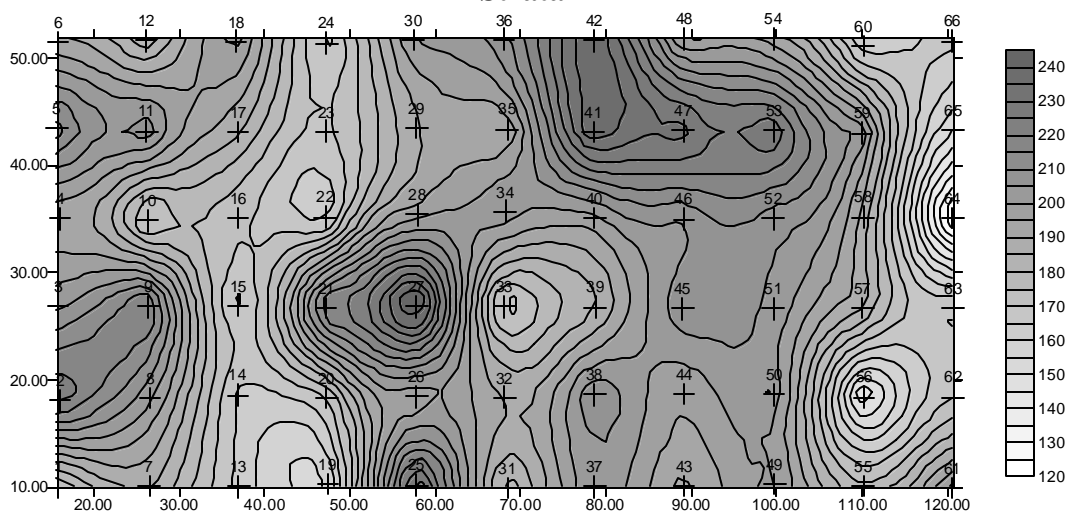


**Strata C**

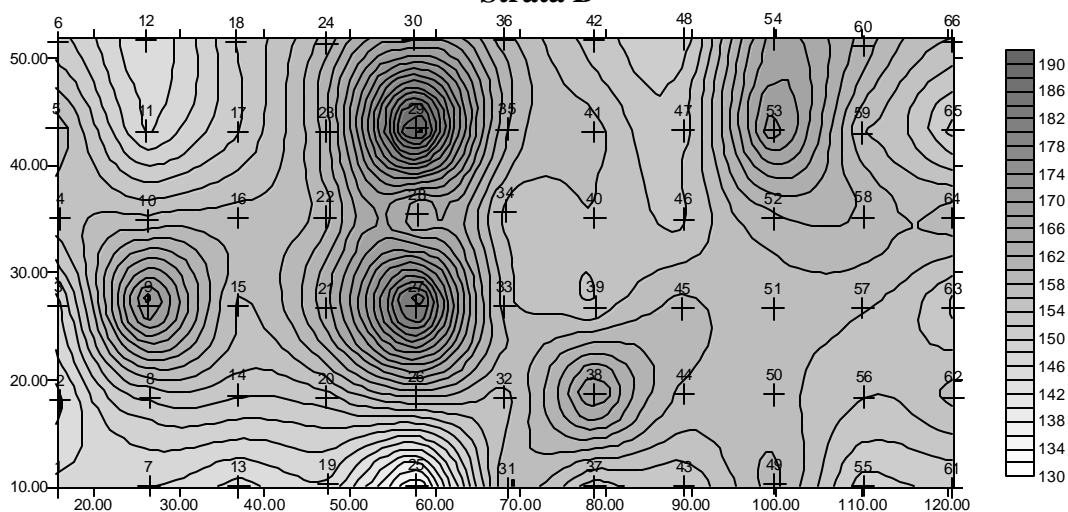
## Appendix BA: Contour Plots, Fluoride (ppb)



**Strata A**

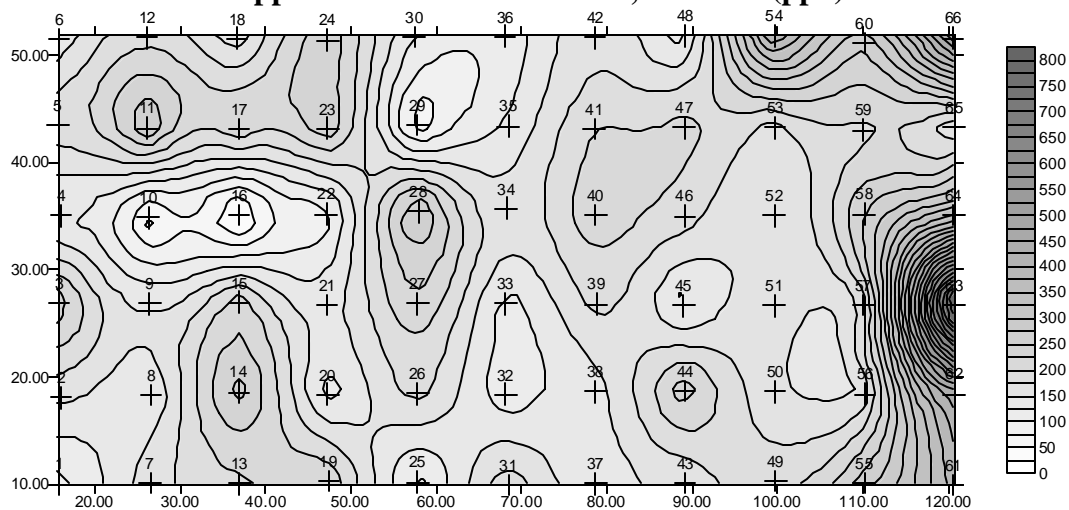


**Strata B**

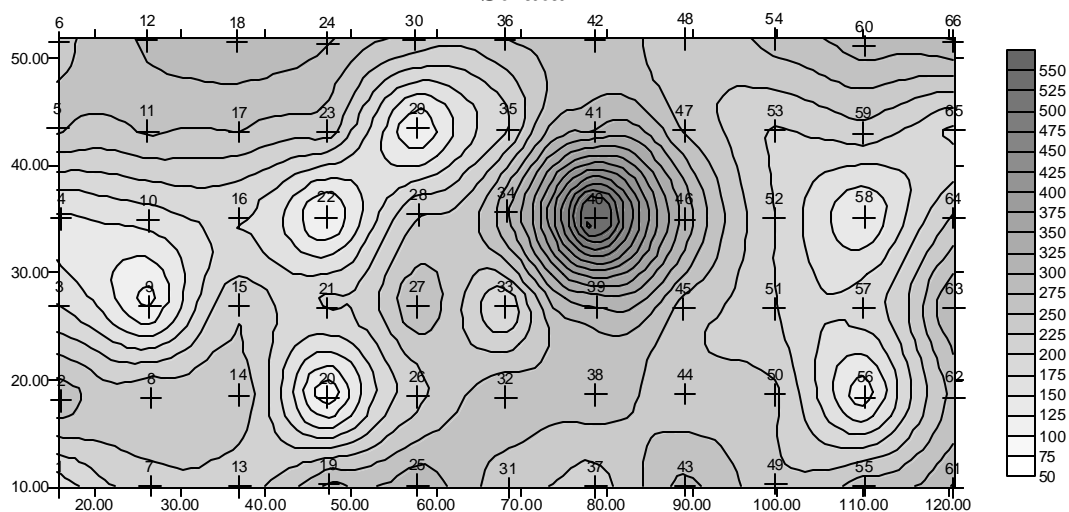


**Strata C**

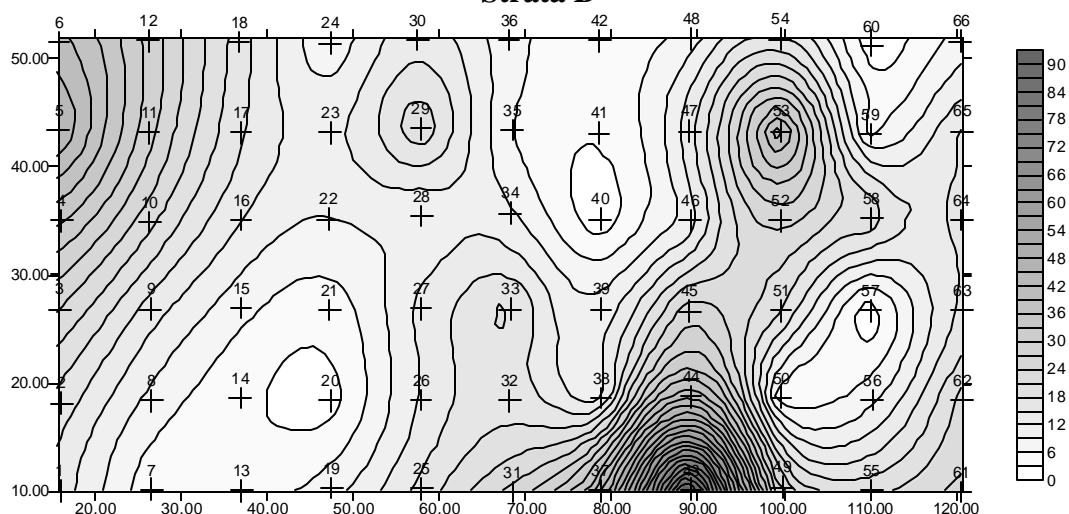
## Appendix BB: Contour Plots, Formate (ppb)



**Strata A**

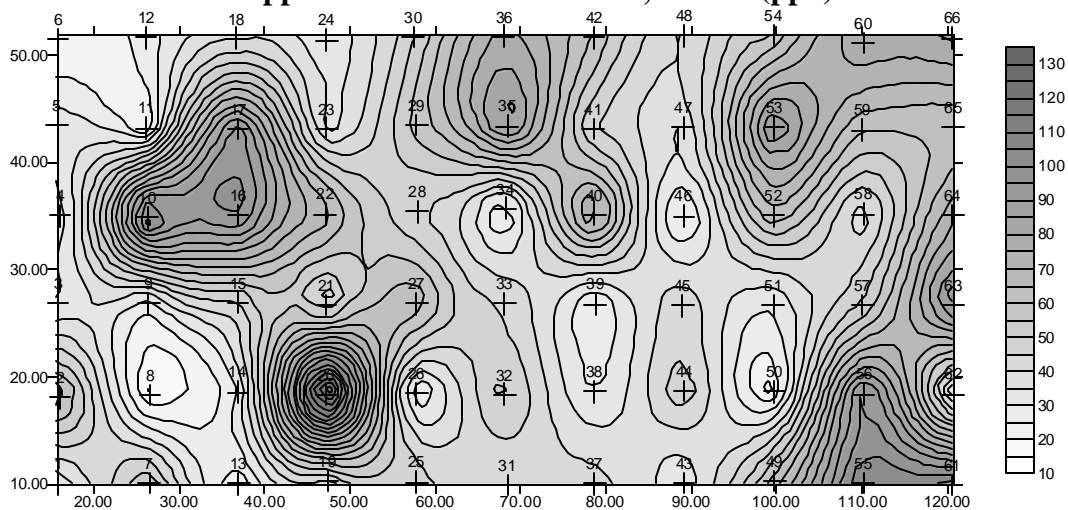


**Strata B**

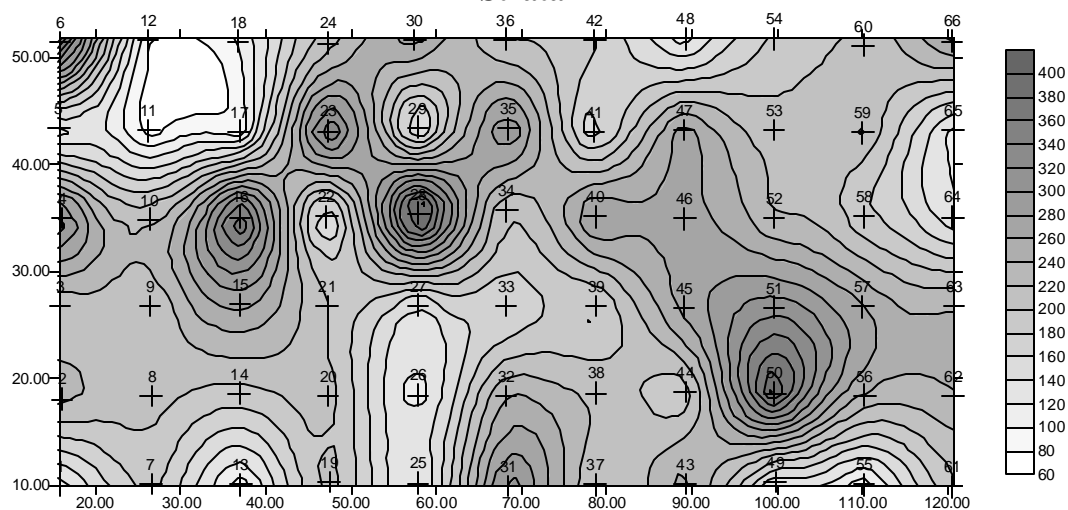


**Strata C**

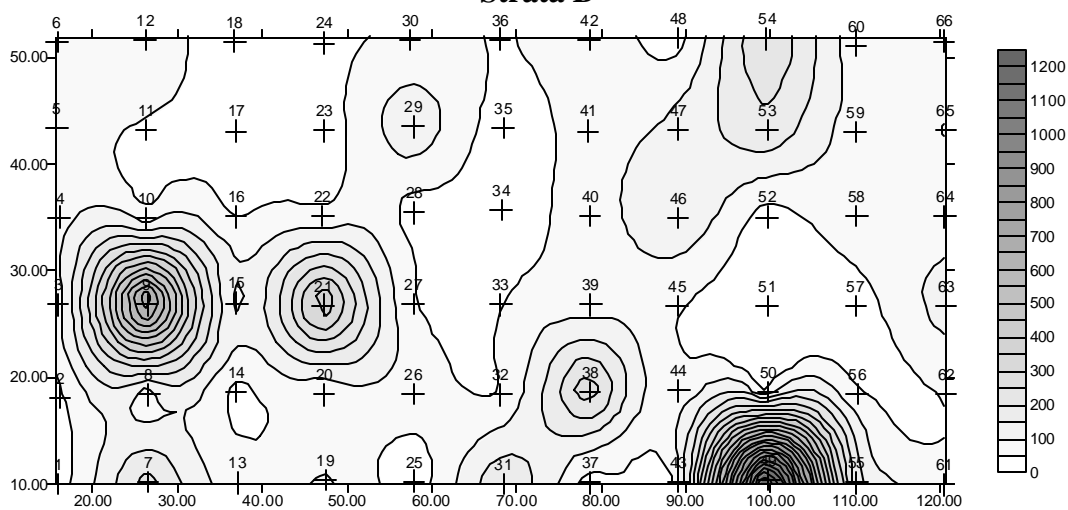
## Appendix BC: Contour Plots, Lacate (ppb)



**Strata A**

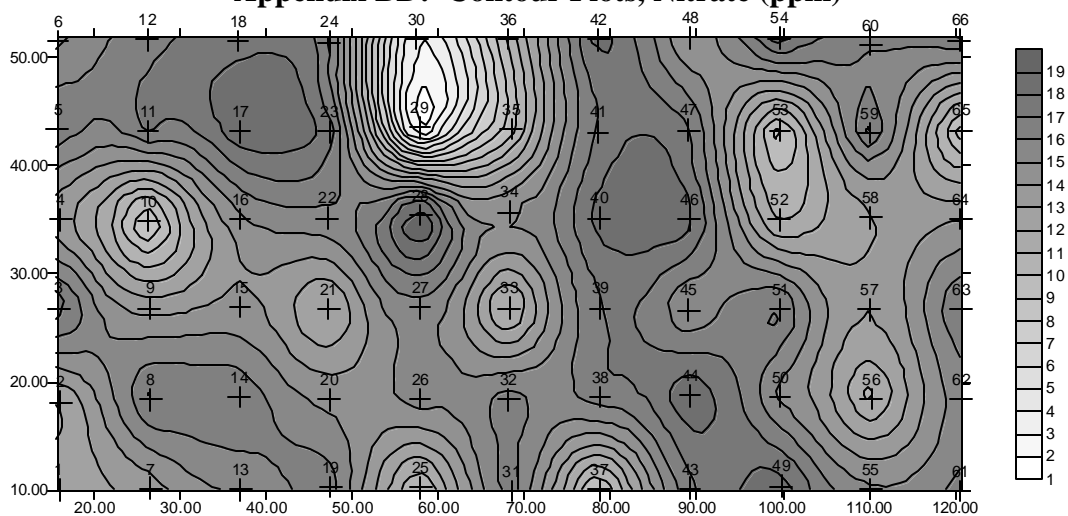


**Strata B**

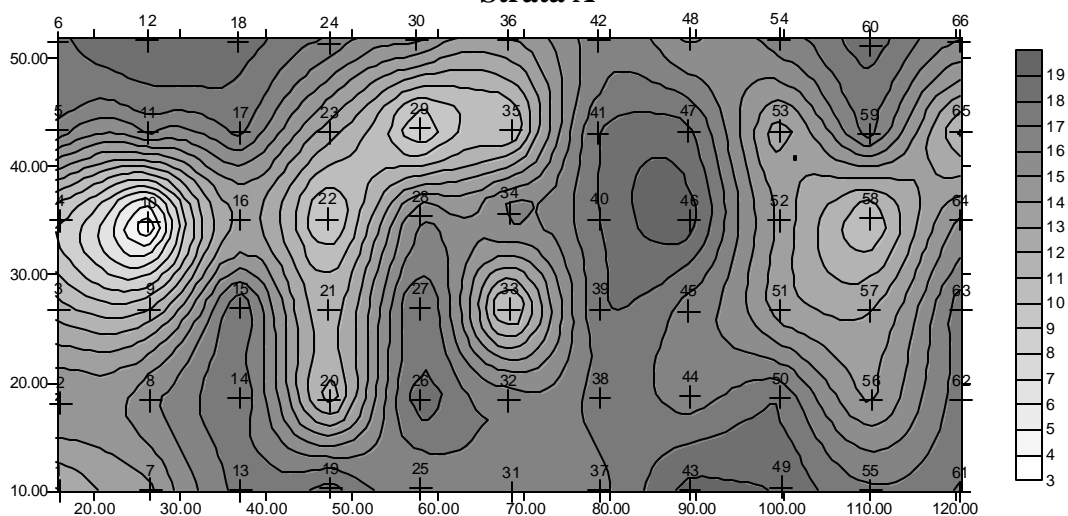


**Strata C**

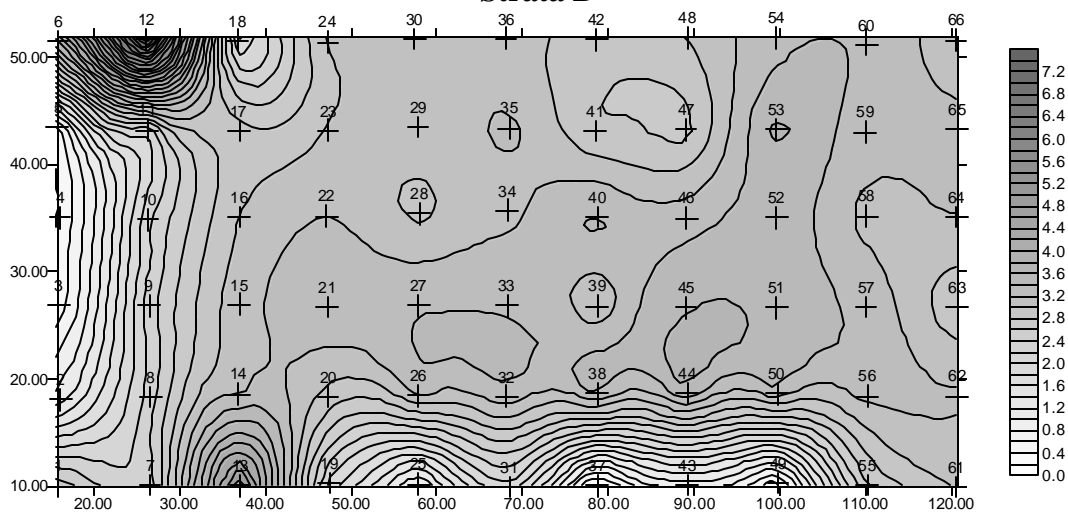
## Appendix BD: Contour Plots, Nitrate (ppm)



**Strata A**



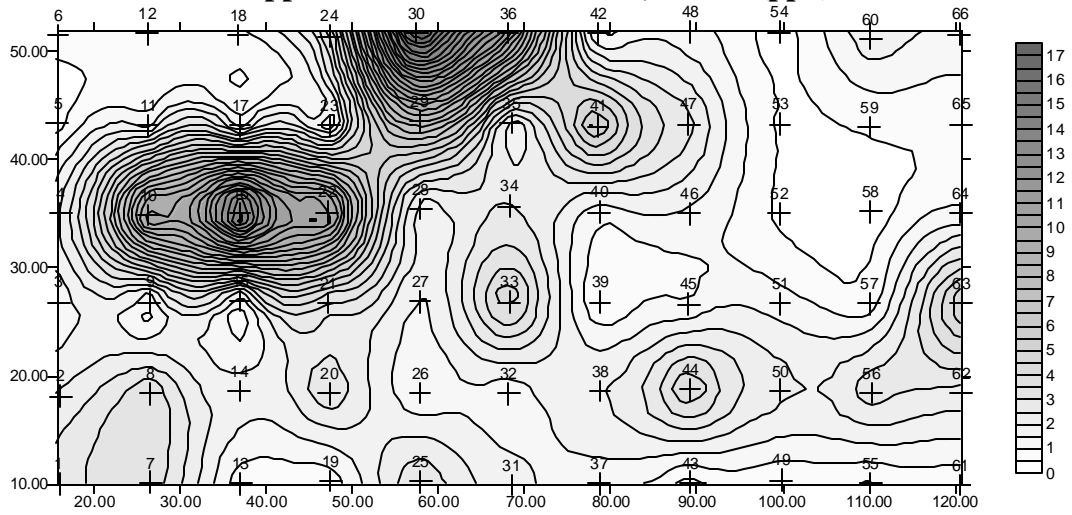
**Strata B**



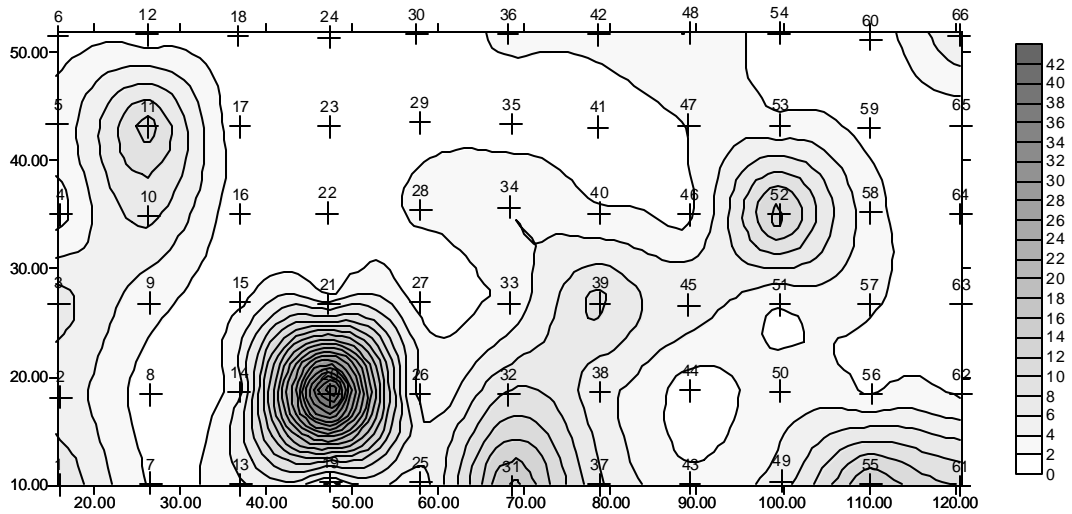
**Strata C**



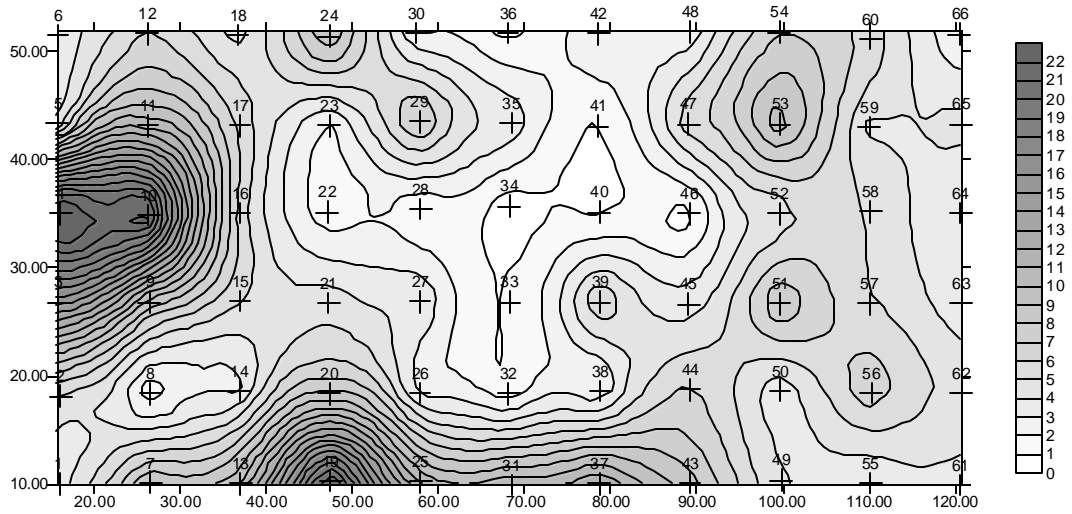
# Appendix BE: Contour Plots, Nitrite (ppb)



Strata A

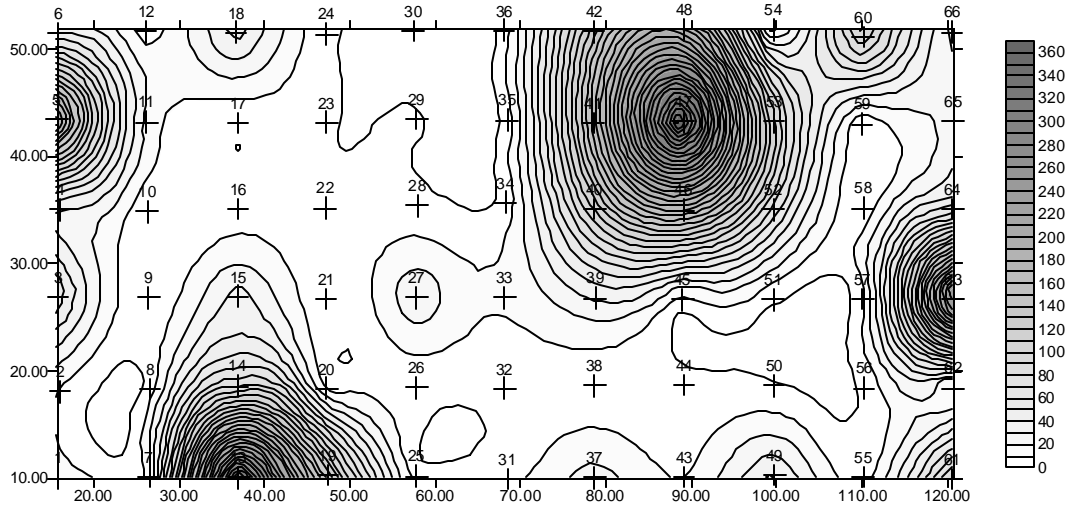


Strata B

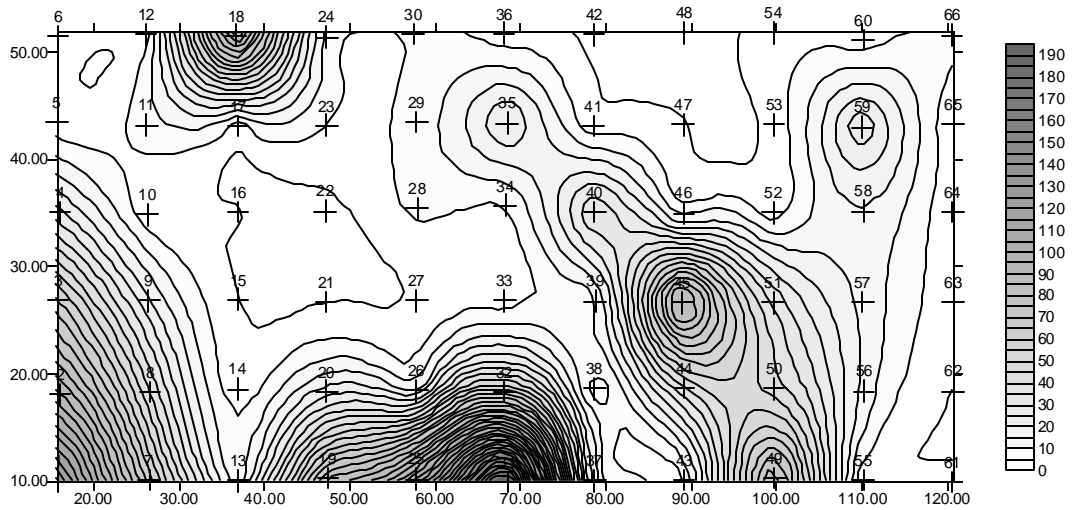


Strata C

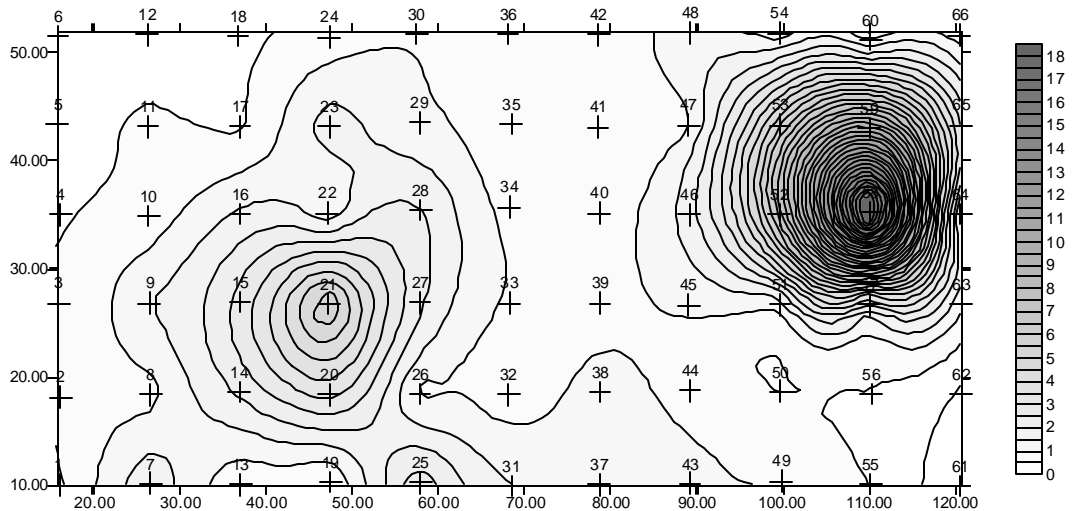
# **Appendix BF: Contour Plots, Propionate (ppb)**



**Strata A**

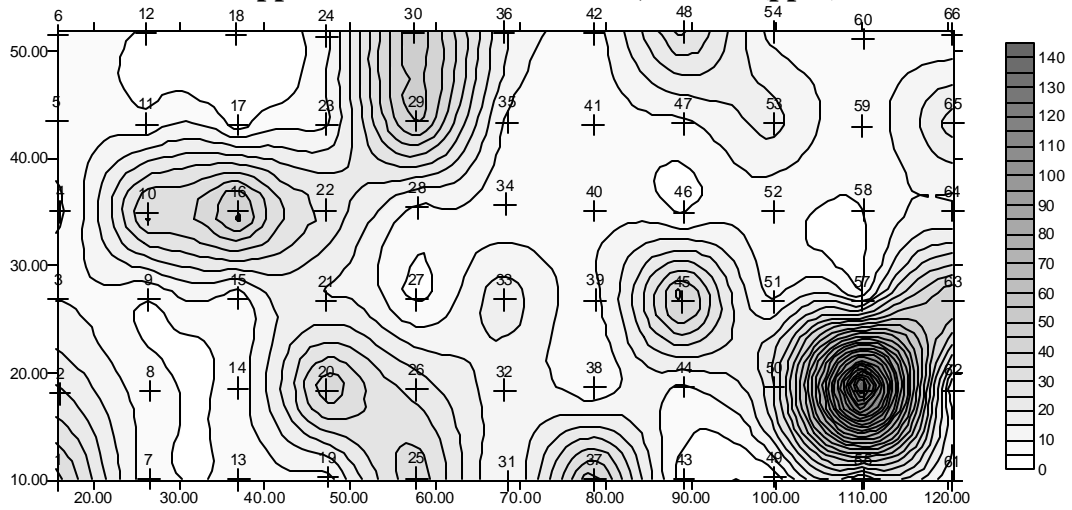


**Strata B**

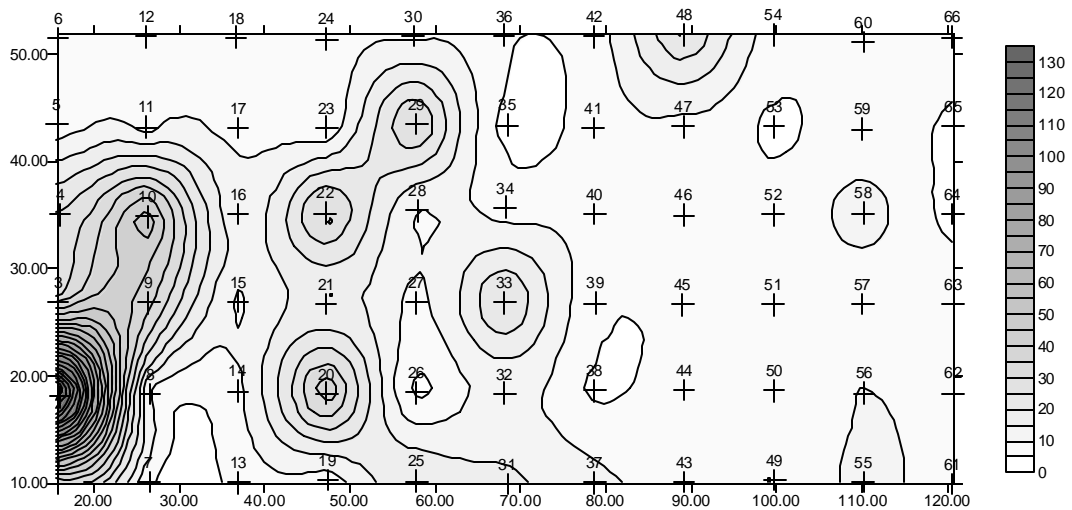


**Strata C**

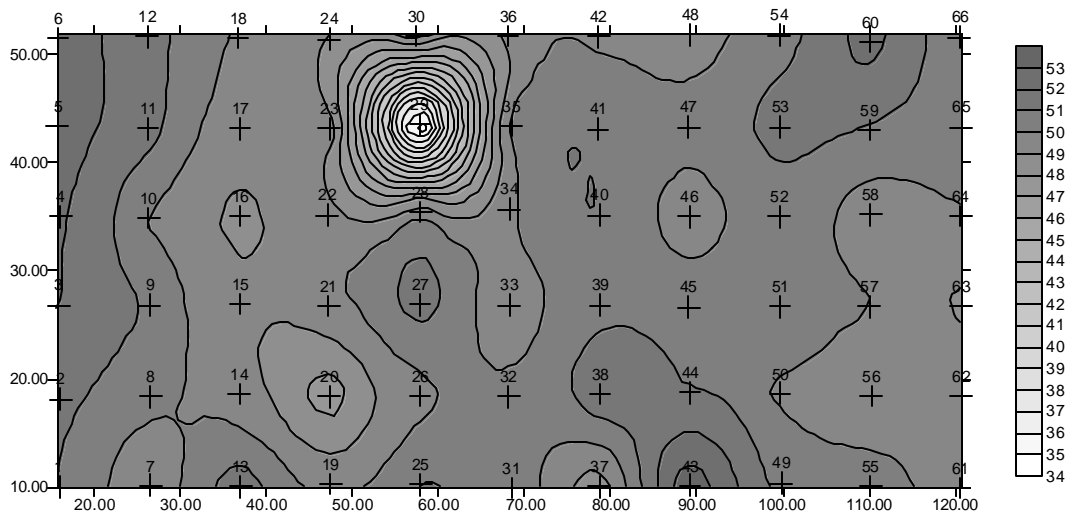
## Appendix BG: Contour Plots, Sulfate (ppm)



**Strata A**



**Strata B**



**Strata C**

## Bibliography

- Aller, Linda and others. *Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells*. EPA 600/4-89/034. Dublin: National Water Well Association, 1989.
- Bagley, D.M. and J.M. Gossett. "Tetrachlorethene Transformation to Trichloroethene And Cis-1,2-Dichloroethene By Sulfate Reducing Enrichment Culture," *Applied Environmental Microbiology* 56 (8): 2511-16 (August 1990).
- Bradley, Paul M. and Francis H. Chapelle. "Anaerobic Mineralization of Vinyl Chloride in Fe(III)-Reducing Aquifer Sediments," *Environmental Science & Technology* 30 (6): 2084-2086 (1996).
- Bradley, Paul M. and Francis H. Chapelle. "Kinetics of DCE and VC Mineralization under Methanogenic and Fe(III)-Reducing Conditions," *Environmental Science & Technology* 31 (9): 2692-96 (1997).
- Bradley, Paul M. and Francis H. Chapelle. "Effect of Contaminant Concentration on Aerobic Microbial Mineralization of DCE and VC in Stream-Bed Sediments," *Environmental Science & Technology* 32 (5): 553-57 (1998).
- Bradley, Paul M. and Francis H. Chapelle. "Methane as a Product of Chloroethene Biodegradation under Methanogenic Conditions," *Environmental Science & Technology* 33 (4): 653-56 (1999).
- Bradley, Paul M. and Francis H. Chapelle. "Aerobic Microbial Mineralization of Dichloroethene as Sole Carbon Substrate," *Environmental Science & Technology* 34 (1): 221-222 (2000).
- Chapelle, Francis H. and others. "Deducing the distribution of terminal electron-accepting processes in hydrologically diverse groundwater systems," *Water Resources Research* 31 (2): 359-371 (1995).
- Chen, Jian. "Determination of organic acids in industrial streams by ion chromatography after solid-phase extraction," *Journal of Chromatography* 739: 273-280 (1996).
- Cizkova, Hana and others. "Organic acids in sediments of wetlands dominated by *Phragmites australis*: evidence of phytotoxic concentrations," *Aquatic Botany* 64: 303-315 (1999).
- Cozzarelli, Isabelle M. and others. "The geochemical evolution of low-molecular-weight organic acids derived from the degradation of petroleum contaminants in groundwater," *Geochimica et Cosmochimica* 58 (2): 863-877 (1994).

Devore, Jay L. *Probability and Statistics for Engineering and the Sciences*. Pacific Grove, CA: Duxbury, 2000.

Entingh, Andrew C. *Groundwater Flow Through a Constructed Treatment Wetland*. MS thesis, AFIT/GEE/ENV/02M-03. Graduate School of Engineering and Management, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, March 2002.

Environmental Laboratory. *Corps of Engineers Wetlands Delineation Manual*. Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS: 1987.

Freedman, David L. and James M. Gossett. "Biological Reductive Dechlorination of Tetrachlorethylene and Trichloroethene to Ethylene under Methanogenic Conditions," *Applied and Environmental Microbiology* 35 (9): 2144-2151 (September 1989).

Gantzer, C.J., and L.P. Wackett. "Reductive dechlorination catalyzed by bacterial transition-metal coenzymes," *Environmental Science & Technology* 25: 715-722 (1991).

Gilbert, Richard O. *Statistical Methods for Environmental Pollution Monitoring*. New York: Van Nostrand Reinhold. 1987.

Gossett, James M. and Stephen H. Zinder. "Microbiological Aspects Relevant to Natural Attenuation of Chlorinated Ethenes," *Proceedings of the symposium on Natural Attenuation of Chlorinated Organics in Ground Water*. EPA/540/R-97/504. Washington D.C.: Office of Research and Development, (1997).

Haston, Zachary C. and Perry L. McCarty. "Chlorinated Ethene Half-Velocity Coefficients ( $K_s$ ) for Reductive Dehalogenation," *Environmental Science & Technology* 33 (2): 223-226 (1999).

Hayashi, Masaki and others. "Water and solute transfer between a prairie wetland and adjacent uplands, chloride cycle," *Journal of Hydrology* 207: 56-67 (1998).

Hedges, J.I. "Compositional Indicators of Organic Acid Sources and Reactions in Natural Environments," in *Organic Acids in Aquatic Ecosystems*. Eds. Perdue, E.M. and E.T. Gjessing. Chichester: John Wiley and Sons, 1990.

Ingersoll, Todd L. and Lawrence A. Baker. "Nitrate Removal in Wetland Microcosms," *Water Resources* 3 (2): 677-684 (1998).

Kramer, J.R. and others. "Variability of Organic Acids in Watersheds," in *Organic Acids in Aquatic Ecosystems*. Eds. Perdue, E.M. and E.T. Gjessing. Chichester: John Wiley and Sons, 1990.

- Lee, M D and others. "New Perspectives on Microbial Dehalogenation of Chlorinated Solvents: Insights from the field," *Annual review of microbiology* 52: 423-451 (1998).
- Liang, Li-Nuo, and Dunja Gribic-Galic. "Biotransformation of Chlorinated Aliphatic Solvents in the presence of Aromatic Compounds Under Methanogenic Conditions," *Environmental Toxicology and Chemistry* 12: 1377-1393 (1993).
- Lontoh, Sonny and Jeremy D. Semrau. "Methane and Trichloroethylene Degradation by *Methylosinus trichosporium* OB3b Expressing Particulate Methane Monooxygenase," *Applied and Environmental Microbiology*. 64 (3): 1106-1113 (1998).
- Lorah, Michelle M. and Lisa D. Olsen. "Degradation of 1,1,2,2-Tetrachloroethane in Freshwater Tidal Wetland: Field and Laboratory Evidence," *Environmental Science & Technology* 33 (2): 227-234 (1999a).
- Lorah, Michelle M. and Lisa D. Olsen. "Natural Attenuation of Chlorinated Volatile Organic compounds in a Freshwater Tidal Wetland: Field Evidence of Anaerobic Degradation," *Water Resources Research* 35 (12): 3811-3827 (1999b).
- Lovely, Derek A. and Elizabeth J.P. Phillips. "Organic matter Mineralization with Reduction of Ferric Iron in Anaerobic Sediments." *Applied and Environmental Microbiology* 51 (4):683-689 (April 1986).
- MacGowan, D.B. and R.C. Surdam. "Techniques and Problems in Sampling and Analyzing Formation Waters for Carboxylic Acids and Anions," in *Organic Acids in Geological Processes*. Eds. Pittman, E.D. and M.D. Lewman. Berlin: Springer-Verlag, 1994.
- Masters, Gilbert M. *Introduction to Environmental Engineering and Science. (Second Edition)*. New Jersey: Prentice-Hall, Inc., 1997.
- McCarty, Perry L. "Breathing with Chlorinated Solvents," *Science* 276: 1521-22 (1997a).
- McCarty, Perry L. "Biotic and Abiotic Transformations of Chlorinated Solvents in Ground Water," *Proceedings of the symposium on Natural Attenuation of Chlorinated Organics in Ground Water. EPA/540/R-97/504*. Washington D.C.: Office of Research and Development (1997b).
- Mercer, J.W. and R.M. Cohen. "A review of immiscible fluids in the subsurface: Properties, models, characterization and remediation," *Journal of contaminant hydrology* 6 (2): 107 (September 1990).
- National Research Council. *Innovations in Ground Water and Soil Cleanup*. Washington, D.C.: National Academy Press, 1997.

Norris, Robert D and others. *Handbook of Bioremediation*. Boca Raton, FL: CRC Press, Inc., 1994.

Opperman, Bryan C. *Determination of Chlorinated Solvent Contamination in an Upward Flow Constructed Wetland*. MS thesis, AFIT/GEE/ENV/02M-07. Graduate School of Engineering and Management, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, March 2002.

Pankow, James F. and John A. Cherry. *Dense Chlorinated Solvents and other DNAPLs in Groundwater: History, Behavior, and Remediation*. Portland, OR: Waterloo Press, 1996.

Pardue, John H. and others. "Design Approaches for Chlorinated VOC Treatment Wetlands." *Proceedings from Wetlands and Remediation, an International Conference*. Columbus, OH: Batelle Press, 2000.

Reddy, K.R., and D.A. Graetz. "Carbon and Nitrogen Dynamics in Wetland Soils," in *The Ecology and Management of Wetlands, Vol. 1: The Ecology of Wetlands*. Eds. D.D. Hook and others. Portland: Timber Press, 1988.

Seagren, Eric A. and Jennifer G. Becker. "Organic Acids as a Bioremediation Tool," *Proceedings of the Fifth International In Situ and On-Site Bioremediation Symposium*, San Diego, CA. April 19-22, 1999.

Smatlak, C. and others. "Comparative Kinetics of Hydrogen Utilization for Reductive Dechlorination of Tetrachloroethene and Methanogenesis in an Anaerobic Enrichment Culture," *Environmental Science & Technology* 30 (9): 2850-2858 (1996).

Tandol, Valter and others. "Reductive Dehalogenation of Chlorinated Ethenes and Halogenated Ethanes by a High Rate Anaerobic Enrichment Culture," *Environmental Science & Technology* 28 (5): 973-979 (1994).

Thurman, E.M. *Organic Chemistry of Natural Waters*. Dordrecht: Martinus Nijhoff/Dr W. Junk Publishers, 1985.

United States Congress. Code of Federal Regulations (CFR), Title 40, Chapter 1, Part 136, (40CFR136). Washington: Federal Register, 2002.

Van Lier, Jules B. and others. "Effects of Acetate, Propionate, and Butyrate on the Thermophilic Anaerobic Degradation of Propionate by Methanogenic Sludge and Defined Cultures," *Applied and Environmental Microbiology* 59 (4): 1003-1011 (April 1993).

Vogel, T.M. and others. "Transformation of Halogenated Aliphatic Compounds," *Environmental Science and Technology* 21 (8): 722-36 (1987).

White, D.C. and others. "The Application of Novel Approaches for Characterizing Organic Acids from Aqueous Matrices Focusing Biological Systems on Environmental Problems," in *Organic Acids in Aquatic Ecosystems*. Eds. Perdue, E.M. and E.T. Gjessing. Chichester: John Wiley and Sons, 1990.

Wiedemeier, Todd H. and others. "Overview of the Technical Protocol for Natural Attenuation of Chlorinated Aliphatic Hydrocarbons in Ground Water Under Development for the U.S. Air Force Center for Environmental Excellence," *EPA/540/R-97/504*. Washington D.C.: Office of Research and Development (1997).

Wilson, Neil. *Soil Water and Ground Water Sampling*. Boca Raton: CRC Press, Inc., 1995.

Yang, Yanru and Perry L. McCarty. "Competition for Hydrogen within a Chlorinated Solvent Dehalogenating Anaerobic Mixed Culture," *Environmental Science & Technology* 32 (22): 3591-97 (1998).



## **Vita**

Captain Bradley M. Bugg graduated from Henderson Country Senior High in Henderson, Kentucky in 1989. He entered undergraduate studies at the University of Kentucky, where he graduated with a Bachelor of Science degree in Civil Engineering on May 8<sup>th</sup>, 1994. He was commissioned a Second Lieutenant through Air Force Reserve Officer Training Corps Detachment 290 the same day.

His first assignment was as a Civil Engineer in the 9<sup>th</sup> Civil Engineer Squadron, Beale AFB, California in August of 1994 where he served in the Engineering Flight. Captain Bugg was awarded “Company Grade Officer” of the year in 1996 before deploying to Prince Sultan Air Base, Kingdom of Saudi Arabia in support of Operation Southern Watch in 1997 as a Readiness Flight Commander. Upon return, he was transferred to Twelfth Air Force at Davis-Monthan AFB, Arizona to coordinate Chairman Joint Chief of Staff (CJCS) exercises for Southern Command and maintain operational plans. In the summer of 2000, Captain Bugg entered the Graduate School of Engineering and Management, Air Force Institute of Technology. Upon graduation he will be assigned to the 16<sup>th</sup> Civil Engineering Squadron, Hurlburt Field, Florida.

<b>REPORT DOCUMENTATION PAGE</b>				Form Approved OMB No. 074-0188	
<p>The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of the collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to an penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.</p> <p><b>PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.</b></p>					
1. REPORT DATE (DD-MM-YYYY) 26-04-2002		2. REPORT TYPE Master's Thesis		3. DATES COVERED (From – To) Aug 2001 – Mar 2002	
4. TITLE AND SUBTITLE  AN ANION CHARACTERIZATION OF A CONSTRUCTED WETLAND USED FOR CHLORINATED ETHENE REMEDIATION				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)  Bugg, Bradley M., Captain, USAF				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(S)  Air Force Institute of Technology Graduate School of Engineering and Management (AFIT/EN) 2950 P Street, Building 640 WPAFB OH 45433-7765				8. PERFORMING ORGANIZATION REPORT NUMBER  AFIT/GEE/ENV/02M-01	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)  AFRL/MLQ Dr Tom Stauffer Barnes Ave Tyndall AFB FL 32403 (850) 283-6059				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT <p>Chlorinated ethene's physical properties as well as its ubiquitous state at DOD installations makes it a priority for innovative remediation efforts. Current techniques are expensive and time consuming to maintain. Constructed wetlands suggest an inexpensive and operational alternative to conventional technologies. Sub-surface flow wetlands provide the anaerobic zones necessary to reduce the recalcitrant chlorinated solvents prior to anaerobic or aerobic mineralization of its daughter products. A vertical flow cell to include sequential sedimentary layers of two hydric soil lifts and a mix of hydric soil and woody compost was the subject of this investigation. This study focused on the statistical significance among the three constructed strata. Concentrations of mono-carboxylic acids and other anions are indicators of the reductive conditions necessary for remediation. Acid anion concentrations were expected to be higher in the assumed anaerobic strata of the constructed cell as a result of the fermentation of humic substances. Decreases in sulfate and nitrate were also expected over the upward flow wing, wetland profile due to the reductive, anoxic conditions.</p> <p>Evidence in this study validate these assumptions and suggest that constructed wetlands are a viable alternative to current remediation methods. Findings also suggest manipulation of the physical parameters such as strata depth, soil type, flow rate, etc...of a wetland could increase the cell's remediation effectiveness.</p>					
15. SUBJECT TERMS Carboxylic Acids, Reductive Dechlorination, Organic Acids, Chloride, Fluoride, Sulfate, Nitrate, Nitrite, Constructed Wetland, Sub-Surface Flow					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Michael L. Shelley, ENV
U	U	U	UU	263	19b. TELEPHONE NUMBER (Include area code) (937) 255-3636, ext 4594
					Standard Form 298 (Rev. 8-98) Prescribed by ANSI Std. Z39-18
					Form Approved OMB No. 074-0188

